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Editorial Comment

It Pays to Give

DUE to the untiring and unremitting effort on the part of the leaders and the most progressive elements of the industry over a period of a quarter of a century, it is safe to say that the electroplater has come out of his shell. No longer is he suspicious, wary and secretive; he gives freely his personal time and knowledge at meetings of the Branches of the American Electro-Platers' Society, and at the Annual Convention.

A rumor has come to our attention, however, that some manufacturers have refused to permit their men to read papers at the coming convention. By so doing, they place themselves directly in the path of progress—which rolls right over them. Secrets to-day are out of date. Any research man can soon learn what is being done around the country. For example, a firm recently refused to permit their plater to read a paper on a specific process. At the next meeting of the Society, a plater from another firm (with their consent) read a paper on the same subject, voluntarily, and told the plater in the more secretive firm things which he did not yet know, and which helped him to produce better and more economical work for his people who thought that they "had something."

Those who live in a shell may hold tight to what that shell contains but they cannot outgrow it. Those who live in the open are unbound and unrestricted. By giving freely they lose nothing, still retaining the knowledge which they have "given away". In return they receive knowledge from others. As a result all are richer.

We know that refusals to permit publication of "inside" methods are growing less common. The continually expanding programs of the American Electro-Platers and other technical societies, are conclusive proof. Nevertheless, even one such instance is one too many. Let the manufacturers encourage their men to write and publish. It will be a very profitable investment.

Purposeful Improvement

ONE of America's great metallurgists, Dr. Paul D. Merica, vice-president of the International Nickel Company, delivered the Howe Memorial Lecture at the recent meeting of the Institute of Metals Division (see METAL INDUSTRY, March, p. 102). Although his subject was Cast Iron, his message had a meaning for other metals.

Cast iron, once the Cinderella of ferrous metals, has undergone a change in the past few years that now make her acceptable even in the society of her more distinguished sister, steel. Better control of melting and casting, the use of alloys, uniformity, heat treatment—all of these factors have contributed to the wonderful improvement and consequently the immensely increased field of usefulness which has necessarily been accompanied by larger consumption.

The brass foundry industry may well take a lesson from cast iron. The brass foundry is still badly in need of a spark plug; something to "boost" the motor, to make the vehicle move faster instead of gradually running down.

In this connection we remind our readers of the coming meeting of the American Foundrymen's Association in Milwaukee, May 3-7. The A.F.A. is making heroic efforts on behalf of the brass foundry. If and when a revival comes it is likely to come through the efforts of the American Foundrymen's Association. There is no better way to be sure to benefit by a rise in the industry than to keep in close touch with its activities and to attend its meetings.

Finish Added to Quality

METAL INDUSTRY has always taken pride in being up to the minute in its editorial content; the last word in shop practice, methods, processes and equipment. Our readers' appreciation is shown by our high percentage of renewals (70-80%) year by year.

In these "lively" times, however, we know that quality alone is not enough. A product must also have finish. So, taking the advice which we have so often given to others, we have improved our finish by bringing our style of make-up in line with the times.

Our readers will note that we now publish our entire journal in three columns. The reason is simple—increased legibility and improved appearance. We have brought forward the Shop Problems and the Metal Casting Digest (formerly Practical Brass Foundry Digest), together with other strictly technical matter, where we believe it belongs. Descriptions of new equipment and supplies follow directly afterward. The balance of the book is approximately as before.

We did not change our dress hastily but only after long and mature consideration. We feel sure that our readers will approve of this change.

Brocading, Engine Turning and Chasing on Metal Articles

Delicate, rich, sharp designs reproduced on metal articles mechanically in quantities at low direct labor costs.

By CHAS. W. HARDY

Industrial Consultant, New York

THESE processes and their application are not new, but they are not generally known. Few concerns, except those in Rhode Island and Massachusetts have heard and know very much about this type of ornamentation and decorating of many high class metal articles. To define the process to one not familiar, it might be explained by likening it to brocaded silk which is embroidered cloth produced mechanically. So is brocading mechanically embroidered on metal. To the layman, it is hand engraving done mechanically. Characteristics produced by the high-lights, shadows, burnishing, etc., which are caused by elevation and depressions of the surface, result in a rich satin sheen on the face of the metal imitating and closely resembling the silk threads of the raised designs on cloth. The contrast as compared with the background is therefore very noticeable. Very intricate tracings, from Italian Renaissance, Parisian and Egyptian designs, to bold plain effects are easily reproduced. Besides which, backgrounds of almost any kind can be made such as Moire, basket-weave, rope, herringbone, checker-board, sun-ray, and plain and fancy line formations in many different combinations.

The Process Is Entirely Mechanical

From history we find that about 1746 in a small Swiss village, some unknown mechanic invented and constructed the first engine turning machine. Today it is still the same in principle as the original conception. We believe from this idea the American made brocading machine was conceived and greatly improved for quantity production.

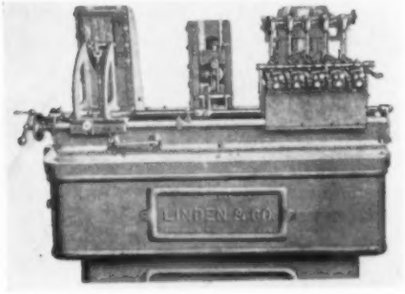


Fig. 1. Straight line brocading machine

These machines are of two types: one for producing circular and oval lines and effects and the other for straight lines; the latter made with multiple chucking attachments for large quantities. Fig. 1 shows a Straight Line Brocading Machine with attachment for five (and multiples of five, depending on length) tubular parts being produced at the same time.

It is remarkable, considering the fine close work, beauty of design, details reproduced, etc., how simple, sturdy and dependable these machines really are.

The Master or Design Plate shown at the upper left hand corner of Fig. 2 is generally a bronze or brass casting—produced by the French sand method and reworked and made smooth before used. It is the basis of reproducing the design to the work, and is readily interchangeable for a variety of different kinds of designs. The expanding chuck is generally made of hard fibre or aluminum and is also easily and readily interchangeable. This is shown on the right side of Fig. 2, directly opposite the Master Plate.

Some Articles That Can Be Brocaded

A great variety of commodities can be brocaded or engine turned. Some are: vanity cases, compact boxes, rouge and lipstick containers, cuff links, belt buckles, dress and coat buttons, lockets, watch cases and dials, pocket knives, brooches, cigarette cases, initials, pens and pencils, lighters, military brush backs, bracelets, various kinds of jewelry, radio parts, automobile accessories, comb, brush and mirror sets, vanity sets, vases, clock parts, silverware, ladies bag frames and ornaments, etc. Some of the designs now being applied to vanity and cigarette cases are shown in Fig. 3. The ornamentation by brocading or engine turning is an exact replica of the Master Plate.

Finishes That Can Be Brocaded

Any electro-plated, immersed, lacquered, enamelled, painted or plain finish can be brocaded or engine turned. Especially is it practical when the base metal is in contrast with the final color. The most recent worthwhile achievement is the anodic treatment and color plate on sheet aluminum in most any color and then the application of the brocading, or engine turning design. The base or aluminum becomes highly burnished and the contrast produces wonderful results. Before this process, sheet aluminum was not much of a factor in the cheap jewelry field. This

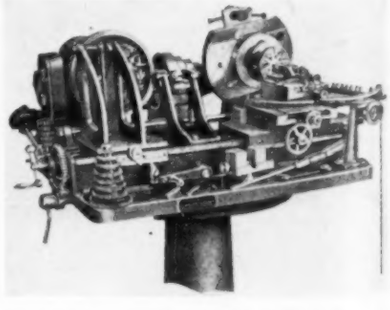


Fig. 2. Brocade machine for circular and oval work

should prove of interest to many manufacturers, especially those who are confronted with the problem of an article that is too heavy to be practical and also the material cost factor. When aluminum is used, it is much cheaper than many other base metals.

Base Metals That Can Be Brocaded

Gold, silver, bronze, copper, brass, Gilder's metal, aluminum, nickel silver, zinc, steel, tin, etc. can all be brocaded. It is not necessary to plate or color the base to apply a brocaded or engine turned design. It can be applied directly to the metal if wanted. It is accomplished by cutting into the metal from .002″ to as deep as desired. Almost any soft metal will lend itself nicely to this kind of ornamentation. In some cases, it is not necessary to remove by cutting the metal; a black diamond is used and it really highly burnishes the design into the surface. The tool used for cutting the design into the metal is ground to the desired shape. Tools are made in standard square sizes and are furnished already ground to a good cutting taper in most any desired length.

Quantity and Quality Production

Production is of course dependent upon kind and style of work and the type of brocading or engine turning. During one of the writer's recent assignments, he was required to determine production and cost data of brocading and engine turning in many different designs on vanity compacts, lip stick containers and cigarette cases. The base metal used was rich low brass (85% copper—15% zinc) and sheet aluminum from .012″ to .020″ thick. Production per hour ranged from 20 to 500 pieces per operator; in some cases one girl operated three machines. In others there were the multiple type, making from two to eighteen pieces at the same time. The time factor is entirely dependent on the particular design of brocading. Some are of a few lines, others requiring as many as 25 different strokes.

On the circular machines, one girl can operate three at one time and it

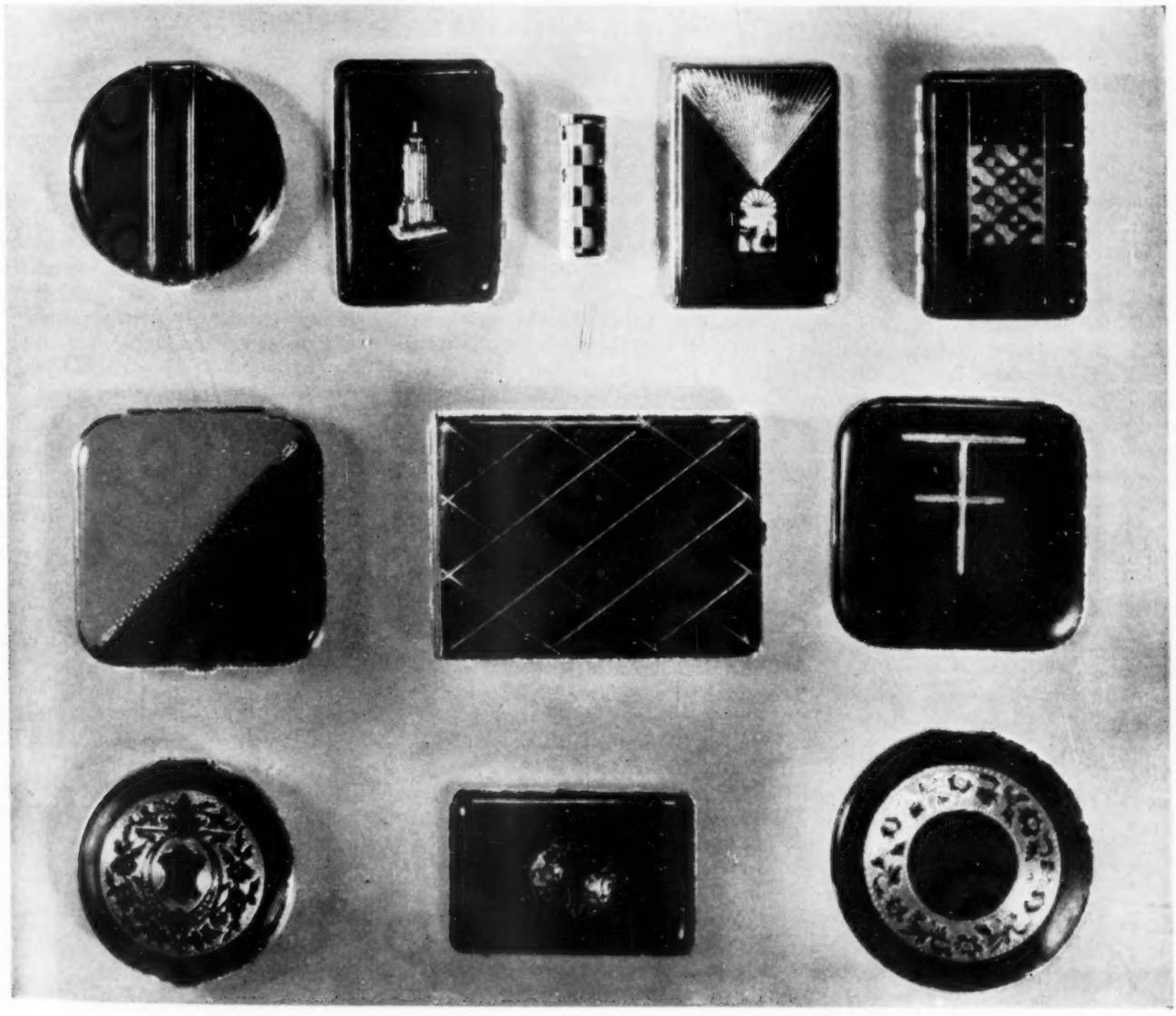


Fig. 3. Some of the designs now being worked into vanity cases, cigarette cases, lip-stick holders, etc., showing square and round work

takes from one to three minutes of actual operating time besides the time for chucking and unchucking per piece of work. This type machine automatically stops when the design has been completely transferred to the work. Spoilage and defective work were less than 1% of the total production and were generally due to a few pieces being spoiled when setting the master plate and adjusting for timing and indexing of the machine.

Cost of Operation Is Low

Direct Labor Costs were surprisingly low; for the simple and plain designs on multiple attachment machines, it cost as low as $.60 per 1,000 pieces of work. For the operation of three machines by one operator, cost from $3.00 to $5.00 per 1,000 pieces. The labor cost of brocading on one machine, one piece at a time, was from $7.50 to $20.00 per 1,000 pieces. The average cost for all work, all machines, all operators, over a period of three months, was $10.00 per 1,000 pieces. Considering the high quality, the various designs, the sharpness, the ease and the quickness in changing of machines, the results obtained and the low labor costs were certainly interesting and surprising to the writer. This department proved conclusively that mechanical brocading and engine turning metal is practical, adaptable, and dependable beyond a doubt. It certainly is, from a decorating or ornamenting standpoint, a successful, simple and economical mechanical process and should lend itself to the application of many articles.

Actual Direct Labor Cost Record

This is a three months record and includes all work engine turned or brocaded during the last three months of 1936 by a large manufacturer of compact and cigarette cases.

			Ave. Cost Per 1000 Pcs.	
Month	*Quantity Made*	*Pay Roll*	*Monthly*	*Cumulative*
Oct.	43,180	$451.29	$10.48	$10.48
Nov.	37,492	368.42	9.81	10.16
Dec.	31,506	316.09	10.00	10.12

Aluminum Foil by the Hazelett Process

ONE of the first to produce aluminum in the Hazelett direct rolling mill is the Crown Cork and Seal Co., of Baltimore, who have now put in operation a plant for the production of aluminum foil by this process.

The direct rolling mill erected at the Waterbury plant of the Scovill Manufacturing Company has produced in the course of a year some tons of brass, but unfortunately the experienced gained in this direction could only be transferred to a limited extent to the direct rolling of aluminum. Nevertheless, the difficulties associated with the problem have been successfully overcome.

The direct rolling mill employed consists of two horizontal rolls, one of which is equipped with a flange, enabling a pool of molten aluminum between 2-5½ in. deep to be supported between them. When the rolls are set in motion, the metal which has initially frozen on to each is carried through, fresh metal from the pool freezing on to the rolls and being carried through in its turn. Actually the aluminum undergoes a combined casting, rolling and extruding action and emerges as a homogeneous smooth surface strip. The microstructure is in agreement with the conclusions reached as to the actual physical characteristics of the process, being midway between that of a cast and that of a rolled metal.

Regarding details, the rolls are provided with a control mechanism which enables them to exert their full effect at once. This is important since the maximum hot reduction takes place at the nib of the rolls. In addition tension is applied to the sheet as it emerges from the rolls, a maximum figure for this being 11 tons in the case of 24 in. strip. While it is hoped shortly to roll directly up to 30 in., 24 in. represents at present the maximum width; the roll pressures involved vary between 715-805 tons, the mill being driven by a 70-80 h.p. motor.

The temperature of the aluminum as it enters the pool of metal between the rolls is about 675° C. and just as the metal leaves the rolls its temperature is 370° C. Immediately after, water is sprayed on to the surface and a few feet further on the metal is cold to the touch. The direct rolled sheet constitutes the first stage in the reduction of the metal to foil. Plant is at present in the course of erection to complete the final stages. The strip will be made dead soft in a vertical annealer, after which it will be reduced in the continuous cold mill from 0.120 in. to 0.040 in. Thence it will be again annealed, and then passed through a large foil mill now being installed. The strip leaves the foil mill 0.002 in. thick, after which it will be given a final anneal.

This cycle from direct-rolled aluminum to foil is particularly favorable when compared with the conventional method of producing aluminum foil. That is, aluminum is usually cast in 200 lb. to 300 lb. slabs about 4 in. thick. Frequently the entire surface is scalped, after which the ingots are hot-rolled eight or ten times down to 0.5 in., usually with one intermediate reheating. These breakdowns then take 12 to 14 passes in a cold roughing mill and emerge about 0.040 in. thick. Two intermediate anneals are usually required. Cold finishing units then reduce the metal from 0.040 to 0.010, with four passes and one anneal, after which it is reduced in a foil mill to 0.002 in. in five passes and with two anneals.

It is apparent, therefore, that this procedure entails considerable scrap loss, requires more time and more individual operations, and, for these reasons, must be decidedly more expensive than for similar foil produced from direct-rolled metal.

Experimental work on the present mill has disclosed various refinements which would facilitate operations. For this reason, a second and larger aluminum mill is at present being designed and will probably be built during next year. The new unit will probably roll strip 30 in. wide, and will have a secondary set of reduction rolls. That is, as the strip leaves the direct-rolling rolls, it will immediately pass while hot through another set of reducing rolls and will emerge 0.06 in. thick. In this way, it will not be necessary to pass the strip through a continuous cold mill. Also through the use of a neutral atmosphere and a reduction in the amount of cooling water, it is anticipated that the metal will have almost a mirror finish.

Die Castings in Automotive Applications

Alloys and their properties; applications of die castings; finishing and design.*

By C. R. MAXON

New Jersey Zinc Co., New York

THAT die castings possess exceptional utility for a wide range of automotive parts is too well recognized to require emphasis here. Among the chief reasons for their use are:

1—Adaptability to rapid production at moderate cost and within closer dimensional limits, not only as compared to other castings, but also as against stampings and forgings.

2—Adaptability to a wide range of shapes and sizes, including complex parts with difficult core work.—Irregular contours and structural elements which, though not so strong, of course, as wrought parts, have unusual toughness (high impact strength) as compared to most low-cost castings.

3—Producibility in some instances with surfaces so smooth as to require little or no polishing or even buffing prior to plating or other finishes.

4—Producibility in remarkably thin sections, yet with a stiffness not attained, as a rule, with stamped parts, —and often with the metal disposed (as in bosses and ribs) in a manner not feasible in stamping and forging.

5—Relative ease of machining, when machining is required, and with a minimum waste in metal removed.

6—Comparative resistance to corrosion under most conditions of service, such corrosion as does occur being confined to the surface and rarely affecting the strength or serviceability of the part.

Limitations of zinc alloys include those involving temperature in service. Prolonged use at temperatures above 300 deg. F. are not recommended. Impact strength is high, as already indicated, under normal temperatures, but decreases rapidly at very low temperatures, although the impact strength is regained with the return to normal temperatures. Despite this fact, breakage attributable to it is rarely reported. It should be kept in mind by designers, however, and an adequate factor of safety allowed, especially with structural parts. With S.A.E. No. 921, containing 2.7 per cent copper, the high initial impact strength is reduced to about one third this value by three years of normal aging in service. The No. 903 alloy, which is copper free and now very widely used, has equally high initial impact strength but does not decrease under any aging condition, although it is temporarily reduced by low temperature, as already noted.

A somewhat newer alloy, No. 925, has been recently adopted by S.A.E. It is the equal of No. 903 in permanence of dimensions and impact strength, while at elevated temperatures, growth of dimensions and loss of impact strength are of lesser magnitude and slower rate than No. 921. It may be used in virtually any application for which No. 921 is suited, and being somewhat more resistant to surface corrosion than No. 903, may be used when additional corrosion resistance beyond that of No. 903 is required or better permanence than can be obtained with No. 921.

The foregoing remarks apply, of course, to standard specification zinc alloys made from high purity (99.99+ per cent) zinc and in which the tin, lead and cadmium content is held rigidly below the maximum allowable limits. All reliable die casters adhere closely to standard specifications and many of them have recently installed modern spectrographic equipment for rigid checking. Alloys made to standard specifications are entirely free from the destructive intergranular corrosion which many years ago was encountered with die castings in which good practice was not followed.

As with most metals, exposure to moisture, especially at elevated temperatures, tends to increase surface corrosion. Continuous or prolonged use in contact with hot water or steam is not recommended. Normal exposures in service of automotive zinc alloy die castings seldom result in corrosion difficulties, but when they may do so, as in occasional carburetor castings exposed to fuels containing water, a simple dipping treatment in a suitable solution affords adequate protection. This treatment, known as "Cronak," is patented by The New Jersey Zinc Company.

Applications of Die Castings

It is inevitable in any paper that comparisons be made of various materials and fabricating methods. The writer has attempted to present competitive materials in a fair light.

Grilles

Although grilles may be regarded as a somewhat special form of die casting, they are prominent because of their position on the car. They are die cast, in fact, quite largely because of their prominence and because it is important from a sales standpoint to have a grille of fine appearance. The author leans to the view that the die cast grille is invariably better in appearance as well as better in other respects than commercially feasible stamped types, though it is not always the cheapest, and perhaps never the lightest, construction. If this is correct, it may well be asked why fewer cars use the die cast form in 1937 than in 1936 models. Many

*From a paper read before the Detroit Section of the Society of Automotive Engineers, Detroit, Mich., March 1.

factors enter into this consideration. One of the reasons for writing this paper is to answer this question, so far as feasible, and it would be interesting to secure in discussion the views of others on the mooted factors involved.

An important and perhaps the primary reason for dropping die cast grilles on some 1937 models was that production facilities were overtaxed in supplying some 1936 models, with consequent delays in deliveries. They were overtaxed largely because the number of die casting machines then available for making one-piece grilles was limited in proportion to the demand.

Polishing and plating facilities were also heavily taxed.

Today there are much better machines available. The placing of orders at the eleventh hour multiplies difficulties. It is also likely to result in grilles which are both heavier and more expensive than they need be if proper forethought were given to the early placing of orders. A sufficient allowance of time should be made for the die caster to try out a die for thin sections before going to heavier ones, if they are needed, to get a good job. At least one grille in production today is, in the opinion of one of the most competent die casters, fully 20 per cent heavier than it need have been if he had been given a little more time to make up the die and try it out.

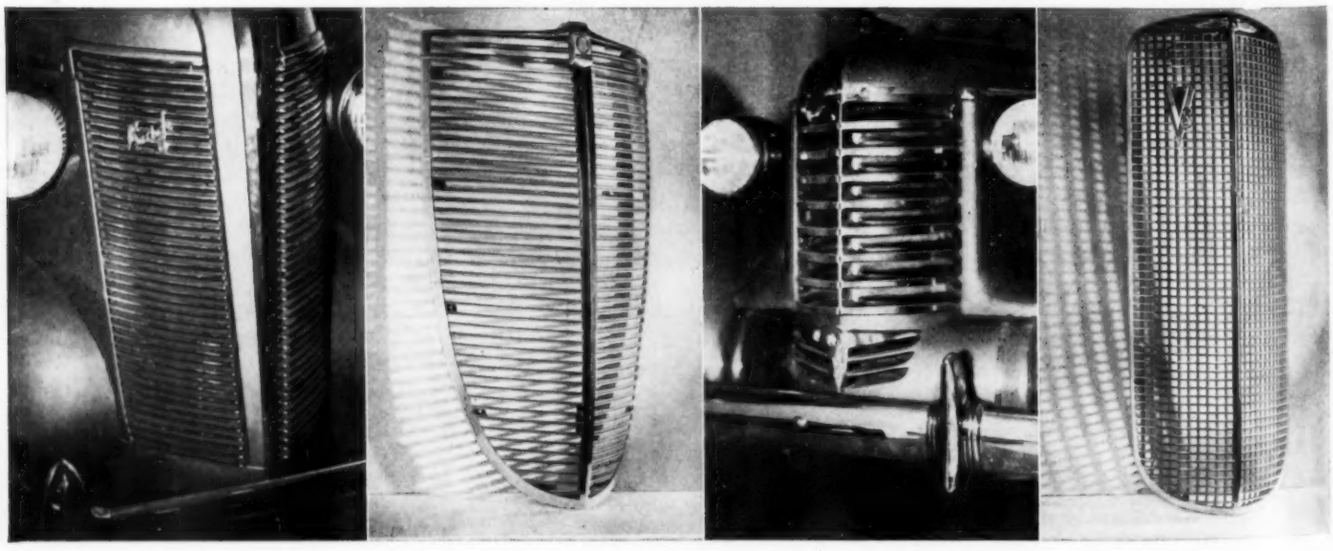
Some grilles are lighter this year than last and others could be made lighter than they are by (a) greater forethought in design, (b) using the grille as a supported rather than as a supporting unit, (c) making the grille of smaller size and/or with larger openings, and (d) using a design which permits of thinner sections. Some of these possibilities have scarcely been thought of, let alone being given really adequate consideration.

Another possibility in die cast grille construction yet to be fully explored is that of the built-up type, of which the Olds six grille is this year's noteworthy example. We understand that an important consideration in going to a built-up design had to do with die construction. Four dies are used in making the component parts, and as more men could work on these than on a die for a one-piece job, the dies could be built more quickly. Though not a factor in this instance, these dies can be and are used in smaller machines than are required for one-piece grilles, and many more of such machines are available. In general, the smaller the casting, the thinner it can be made, and this may result in weight saving, though we understand there was none in this instance. In this grille the castings are of nearly semicircular shape and they are placed in pairs on a rotating fixture, which facilitates polishing in an automatic machine.

It is understood that this grille was suitable for either built-up or one-piece construction, but it is difficult to see how it could have been polished with satisfaction in one piece. In any case, the polishing setup is efficient and production cost is reported somewhat lower than for a one-piece design, especially in respect to plating. An advantage of a built-up grille is that it is not necessary to replace the entire unit if an accident results in breakage or injury of one or more parts while others remain suitable for use.

Today, those who style the cars appear to have most to say as to the design of grilles and of other nonfunctional members to be die cast. Their first concern is naturally and properly with appearance, but there are undoubtedly many cases in which they could save in the expense as well as in the weight of die cast parts if they would work closely with the die caster in the early stages of the design, and without any sacrifice in appearance of the finished design. Three 1937 cars have die cast grilles of honeycomb design. These are difficult to cast with a good finish suitable for plating and are also hard to clean of fins. Each hole, of which there are over 1,200 in some designs, means a core and often a resulting fin which is almost sure to require some hand filing on four sides of each hole! Machine cleaning is done to some extent where a saving results, but some hand cleaning is unavoidable and the cost is high when so many holes are involved.

1937 Automobile Radiator Grilles



Buick *Lafayette* *Oldsmobile "6"* *LaSalle*

In respect to costs, that for the die and cleaning tools for a one-piece die cast grille usually runs from $14,000 upward, perhaps to $25,000 or more, but is far below the tooling for a stamped grille and may bring the total cost per grille, tools, included, lower for the die cast than for the stamped grille, at least where the total number of grilles required is moderate. Upward of $300,000 is said to have been the tooling cost for making a stamped grille for one of the highest production cars. The production rate is high and could not be equaled with a single or perhaps even two or three die casting dies, but the difference in tooling is striking even if offset by lower unit costs, especially when the difference in appearance of the product is considered.

An engineer with one of the most experienced users of die cast grilles recently wrote as follows: "In our opinion, die castings will increase in usage in the automotive field, particularly as applied to body and sheet metal parts. In fact, die cast parts are on the increase because of the neatness of appearance, accuracy and uniformity of dimensions, also their cheapness as compared to stampings of equal appearance. We realize that many die castings may be replaced with stampings, but in most instances the part suffers greatly in loss of character in adapting to a stamping.

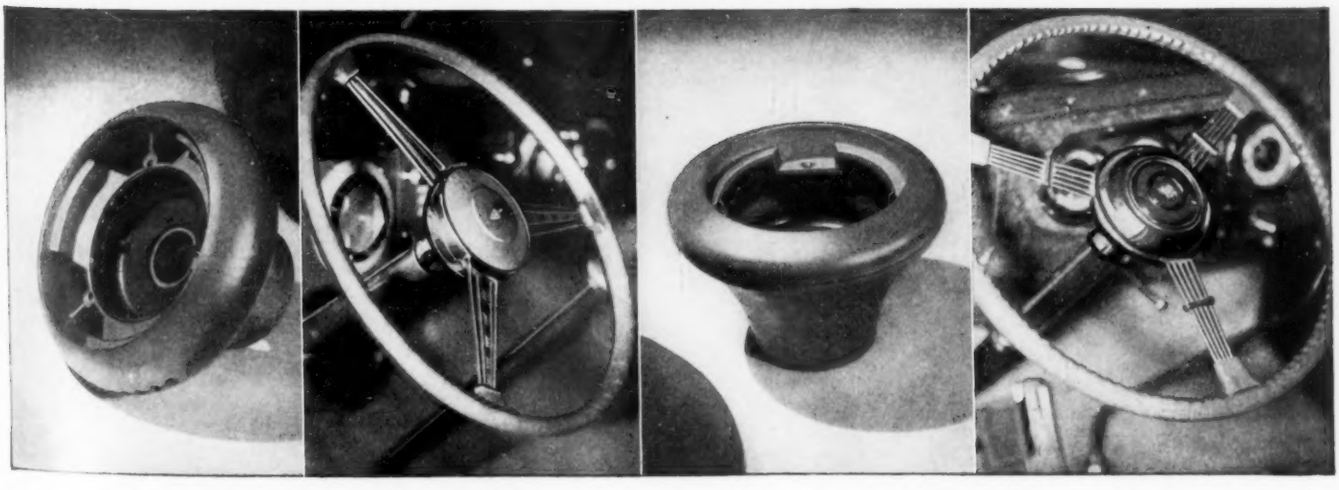
"We do not consider die cast grilles more expensive than other types which have the same fine characteristics and appearance. At the time we adopted the die cast grille in 1935, the most important reason for doing so was based on the cost standpoint. During the previous year, our grille costs were nearly 50 per cent higher than the cost of the die cast grille, due principally to inability to control accurately the stamped parts which made up our grille and to control accurately the size and shape of the assembled stamped grille. Die cast grilles have one great advantage, i. e. dimensions, shapes and appearance may be held uniform. We do believe that the die cast grille has presented a sales asset."

Steering-Wheel Applications

Die cast hubs for steering wheels, especially the deluxe type with wire spokes, are extensively used and are an excellent example of an application which is largely structural in character. These hubs vary in weight from about 1.3 lb. to 6.5 lb., a difference which would seem to indicate that some hubs are heavier than they need be for purely structural reasons. Difference in size, which in turn is dictated in part by the stylist's ideas of correct proportions, have much to do

Interior of a wrecked Buick 60 car. The de luxe spring-spoked wheel is bent but not broken and probably saved the life of the driver

Steering Wheel Hubs



Graham *Oldsmobile* *LaSalle* *Packard*

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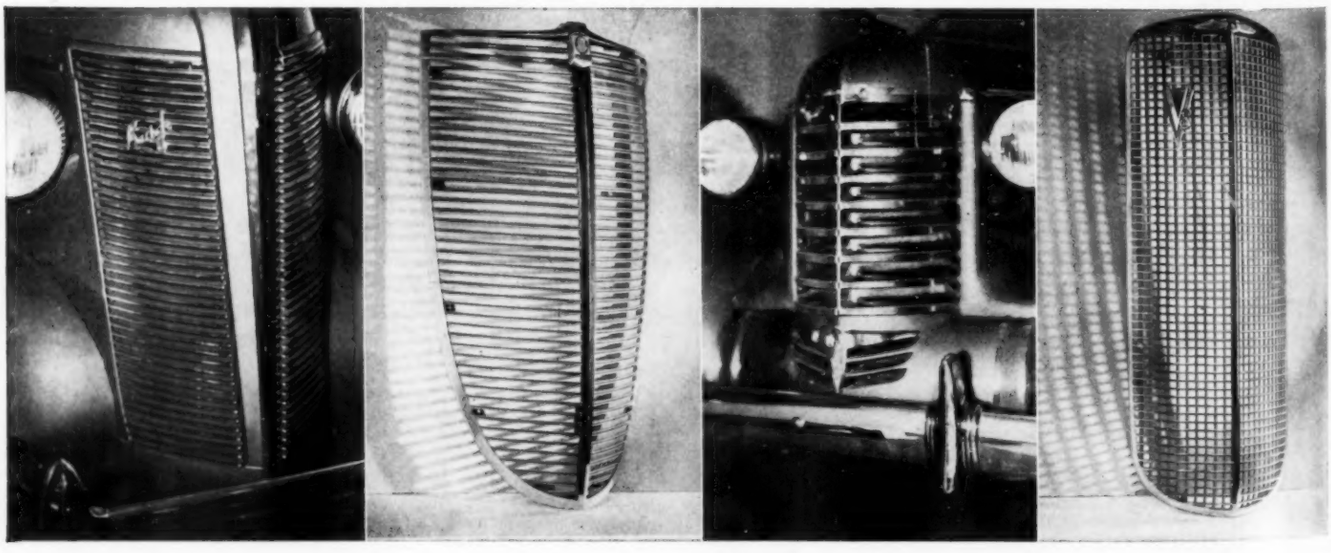


Buick *Lafayette* *Oldsmobile "6"* *LaSalle*

In respect to costs, that for the die and cleaning tools for a one-piece die cast grille usually runs from $14,000 upward, perhaps to $25,000 or more, but is far below the tooling for a stamped grille and may bring the total cost per grille, tools, included, lower for the die cast than for the stamped grille, at least where the total number of grilles required is moderate. Upward of $300,000 is said to have been the tooling cost for making a stamped grille for one of the highest production cars. The production rate is high and could not be equaled with a single or perhaps even two or three die casting dies, but the difference in tooling is striking even if offset by lower unit costs, especially when the difference in appearance of the product is considered.

An engineer with one of the most experienced users of die cast grilles recently wrote as follows: "In our opinion, die castings will increase in usage in the automotive field, particularly as applied to body and sheet metal parts. In fact, die cast parts are on the increase because of the neatness of appearance, accuracy and uniformity of dimensions, also their cheapness as compared to stampings of equal appearance. We realize that many die castings may be replaced with stampings, but in most instances the part suffers greatly in loss of character in adapting to a stamping.

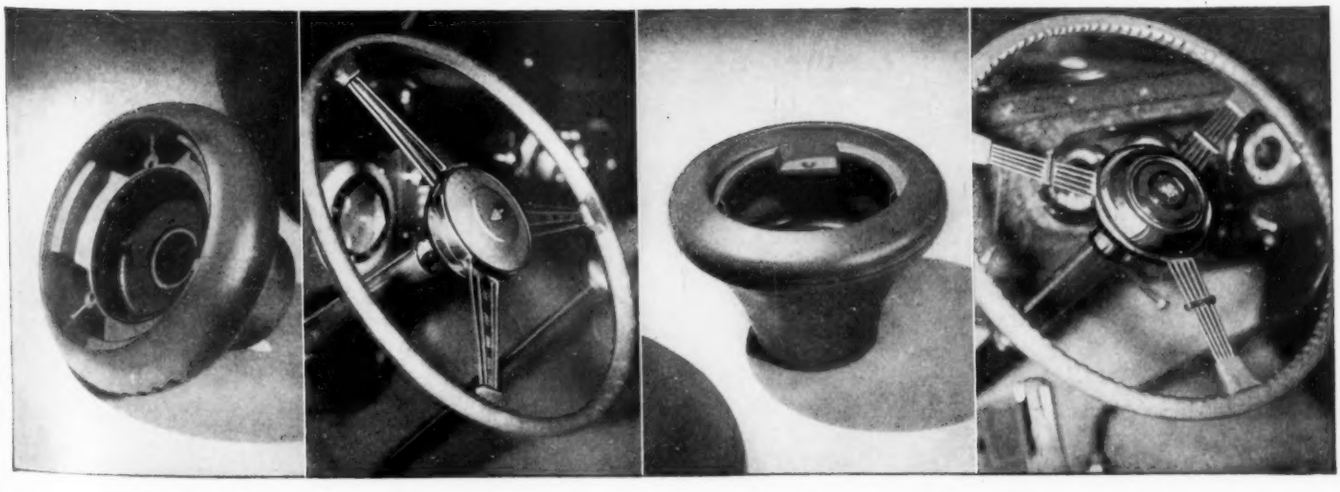
"We do not consider die cast grilles more expensive than other types which have the same fine characteristics and appearance. At the time we adopted the die cast grille in 1935, the most important reason for doing so was based on the cost standpoint. During the previous year, our grille costs were nearly 50 per cent higher than the cost of the die cast grille, due principally to inability to control accurately the stamped parts which made up our grille and to control accurately the size and shape of the assembled stamped grille. Die cast grilles have one great advantage, i. e. dimensions, shapes and appearance may be held uniform. We do believe that the die cast grille has presented a sales asset."

Steering-Wheel Applications

Die cast hubs for steering wheels, especially the deluxe type with wire spokes, are extensively used and are an excellent example of an application which is largely structural in character. These hubs vary in weight from about 1.3 lb. to 6.5 lb., a difference which would seem to indicate that some hubs are heavier than they need be for purely structural reasons. Difference in size, which in turn is dictated in part by the stylist's ideas of correct proportions, have much to do

Interior of a wrecked Buick 60 car. The de luxe spring-spoked wheel is bent but not broken and probably saved the life of the driver

Steering Wheel Hubs



Graham *Oldsmobile* *LaSalle* *Packard*

with the weight, but where weight saving is considered important, a study looking toward better metal distribution might well be made in some cases. It is quite common practice to use a steel insert to which spokes are welded and it might result in some weight saving if the insert were extended to include the keyway, where stresses may be highest.

Differences in the design of interior parts of the hub are chiefly those incident to spoke fastening. One of three methods of fastening is usually employed: welding to a steel insert, use of a ring fitting into an annular groove which includes notches cut in the spokes, or screwing the spokes into place. In some designs using a steel insert, the latter is put in place after casting. This saves some time in the casting cycle and has the advantage that welding surfaces are free of zinc. Where the insert is cast in place it is, in at least one case, made a press fit on the core pin and has to be forced over this pin before the die is closed for casting. This requires some special tooling and lengthens the casting cycle with no apparent benefit except to keep the zinc away from the welding surface.

Three to five wires are used to form each spoke and the holes for these can be cored if the axes of those in each group are made parallel rather than radial. If flat strip spokes displace some round wire, as in the Olds wheel, it is necessary to core the holes for them because of the expense of machining a hole to fit. The coring of holes for wires of circular section as well as those for flat strip naturally increase die cost and may lengthen the casting cycle slightly, but it avoids the need for drilling. A good setup for drilling, using, for example, three Kingsbury or equivalent drill units and an indexing fixture permits of rapid drilling at low cost, even though the drilling of small deep holes requires some care to avoid drill breakage. When spokes are threaded into the holes, it is possible to make them form their own thread, hence separate tapping is not essential.

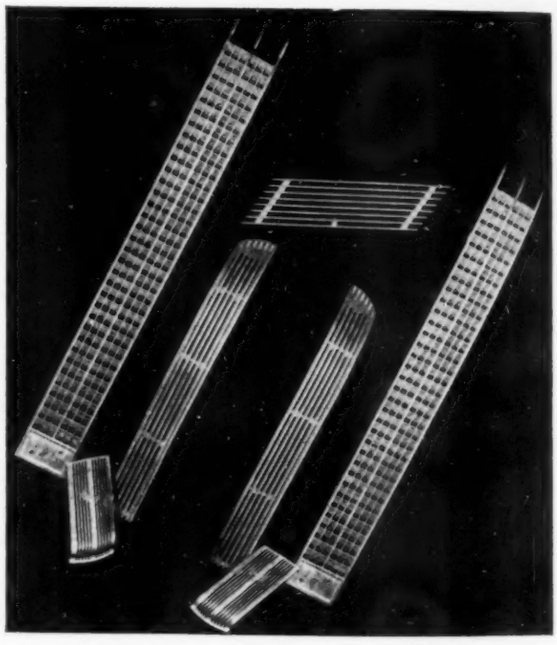
Despite the stresses imposed on steering wheel hubs, the author does not know of any cases in which breakage has occurred. An accompanying illustration shows what happened in the wreck of a Buick "60" in a collision resulting from the car running down hill out of driver control, and striking a street car head on. The driver, thrown against the wheel, was hurled into the rear seat sustaining a broken leg and minor head injuries. Although the steering column is bent and the wheel was forced forward so that it dented the instrument panel and was badly distorted, neither the spokes (of Firth Sterling stainless steel) nor the diecast hub were broken, in spite of the fact that the engine was broken loose and pushed back to within about 18 in. of the driver's seat. Had the wheel broken, the driver would probably have been much more seriously injured if not killed. This incident appears to indicate that a flexible-spoke steering wheel may be a safety factor besides having other advantages.

Other applications of die castings to the steering wheel include the horn ring on the 1937 Buicks with de luxe steering wheels. This ring, spokes included, is a light and surprisingly flexible one-piece die casting of zinc alloy. It is cast with the hub web solid and this is afterward split by saw cuts equi-distant between spokes.

The horn ring is also a safety feature, as the driver need not remove either hand from the wheel to sound the horn.

Ford light-switches, which surround the horn button, are being die cast this year, whereas a year ago they were molded from plastic and had a die-cast insert. This change is understood to have represented some cost saving and also to have avoided certain difficulties in color matching encountered with the plastic. A Macoid finish to match other interior parts is now applied. Castings are made in a two-cavity die running 400 to 450 shots an hour, and giving a very smooth surface. The only subsequent operation on these castings prior to applying the finish (aside from breaking off the gate and inspection) is an operation performed in a punch press at the rate of about 1500 pieces an hour.

As against this another steering wheel hub if cast in a two-cavity die at about 100 shots an hour, the slower rate being a result of using a steel insert which has to be forced over a core pin (to prevent zinc from coating the inner surface). A special loading fixture for the inserts is needed and has to be lowered between the die halves between shots and the die partly closed to force the rings over the core pin. Cleaning of the hub is done in a press with a shaving die after which the hub is inspected and shipped. Spoke holes in this hub are drilled subsequently in the car manufacturer's plant, where also the central hub hole is reamed and the keyway broached, spokes inserted and welded to the steel insert. Finish includes a priming coat baked for 15 min. and a final coat baked 2 hr. and 40 min.



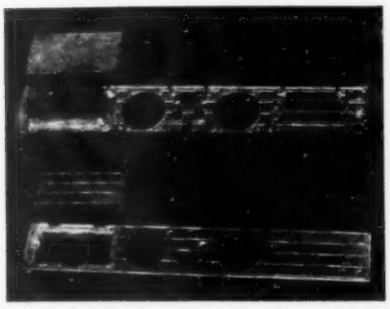
Die cast louvers as used in Cadillac, Packard, Chrysler and Lincoln Zephyr. The two largest ones match the Cadillac die cast grille in design motif, but the others are used on cars with stamped grilles

Windshield and Window Frames

The use of die castings in windshields for open and convertible models is far from being new. Some

complete windshield frames have been die cast in one piece, one Cadillac job weighing 33 lb. and measuring 50 x 22 in. over all being among the largest die castings produced. Only 400 to 500 a year were required, yet the saving in finishing as compared to a sand casting warranted the constructing of the very large die. This was used some years ago and we understand is not now in production. With the introduction of improved methods of body construction, including improved welding practice, windshield design has changed radically.

Many windshield stanchions and separate windshield frame parts are still used and serve their purpose well,



Instrument panel and glove-compartment door as die cast in remarkably thin sections for use on Cadillac cars

but such stanchions are exceedingly heavy in most designs with which the author is familiar. Die castings are used for these parts primarily because they supply the required sectional contours and yield a non-rusting support which is readily plated or otherwise finished. It is the author's opinion that weight might be greatly decreased and strength increased by using a properly designed steel insert running from end to end and thinner sections, although this might not decrease cost. As present designs, in general, are used only on models in which production is relatively small, studies of weight saving appear not to have gone so far as they might. Certainly, if stanchions which are more slender were provided, the blind spot which they create could be reduced with some gain in safety.

Another example of structural use of die castings is in the frames for D-shaped ventilating wings and quarter windows. Such parts have the required supporting bosses for pivots and limit stops and can be made quite light, though perhaps a little heavier than formed steel frames. Important advantages are the closer dimensions which can be held and the freedom from rusting which the use of a zinc alloy secures. When a rubber cover for sealing purposes is desired, the die casting can be brass plated and used as an insert in the mold forming the rubber cover which is vulcanized to it.

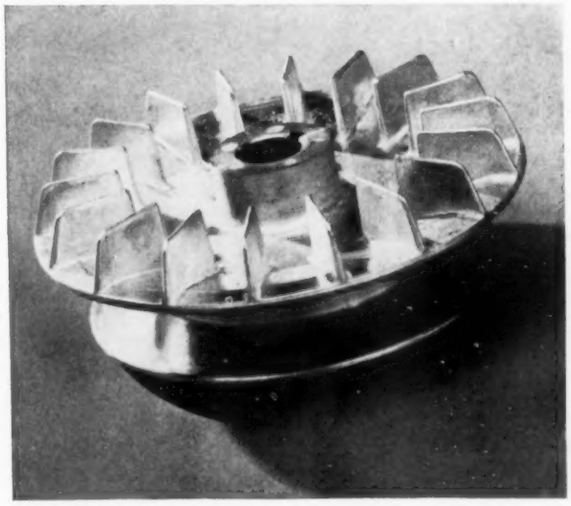
In some General Motors applications of this nature, the outer frame for a front window has been die cast, roughly in F-shape. The lower projection extends into the door and the center section is adapted for mounting a die-cast regulator having a vertical pivot about which the inner frame, carrying the glass, turns. This makes a substantial superstructure as well as a firm fastening for screwing or riveting to the frame of the door itself. The assembly takes the place of one which, if not die cast, would have to be built up from several stampings which would probably cost more and be much more difficult to hold within the desired dimensional tolerances.

As already noted, window regulator parts, which may include gears and sprockets as well as housing parts, are readily die cast and give good service in that form, frequently being lower in cost than equivalent stamped or machined parts. Hardware for regulators and doors is treated under another heading.

Louvers and Exterior Body Parts

Extensive application of die castings as louvers and decorative applications on hoods is a further tribute to their fine appearance and low comparative cost. Again it must be admitted that the die casting in such applications adds weight which is justified chiefly on the basis of improved appearance, and appearance which cannot be attained at all with stamped parts in some cases, and in other instances only with a much larger expenditure in tooling. Those interested in weight saving can undoubtedly gain it and still take advantage of the die casting, however, if they will set this objective, cooperate closely with the die caster and give him an opportunity to work out die construction such as to yield the lightest feasible sections.

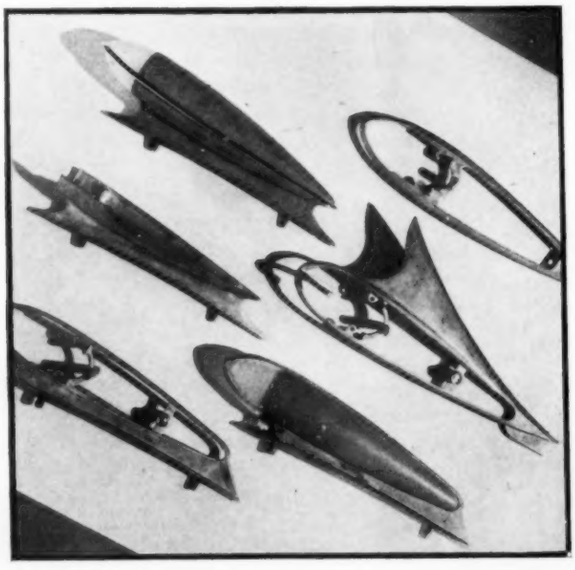
It is well to remember in this connection that it is entirely feasible today to die cast either straight or curved moldings of almost any length up to 50 in. or more in a great variety of sectional shapes and surprisingly thin, but with convenient fastening bosses such as are not readily provided in stamped or rolled moldings. In some cases, these moldings can even be made flexible enough to conform to variations in stamped parts. An example of this is the D-shaped moldings, a pair of which are used to outline the grille on current Dodge models. These moldings have a section thickness of about 1/32 in. and are about 9/16 in. wide. Overall dimensions of the D-shaped casting are approximately 30 x 8 in. and represent about 60 linear inches of molding with bosses spaced about 5 in. apart. Casting is done at the rate of about three shots a minute and with so little flash that cleaning is a very simple and rapid process. The molding is quite flexible and conforms readily to inequalities of mating stamped parts.



Pulley with flanges for V-belt and integral cooling vanes for air circulation through the lighting generator which it drives. It is typical of somewhat complex parts which are readily die cast at low cost

As to irregularly shaped parts such as are used for decoration on and

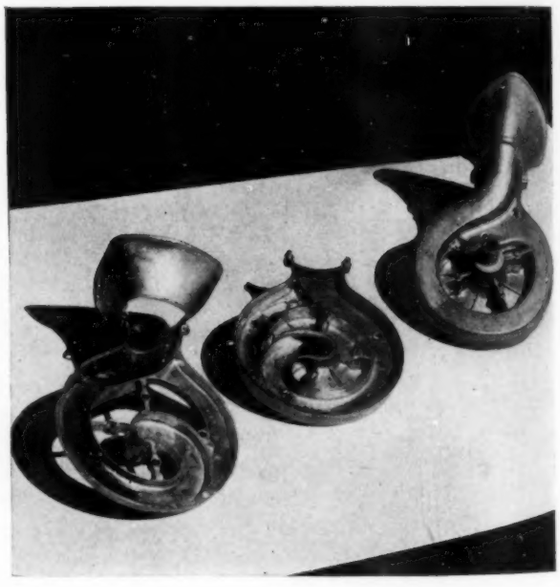
about the radiator shell and sometimes on fenders and headlamps, the die casting is so well suited as to have little or no competition. Such parts are usually designed largely by the stylist, who presumably leaves to the engineer the matter of fastening the casting to mating parts. Fastening is usually done by hidden screws or studs, some of the latter being cast in place in certain instances, but other methods of fastening are deserving of mention, as they may reduce the cost of the finished piece and of the assembly operation.



Mounting parts for fender lamps on the order of those shown here are readily die cast and would be difficult to make in streamlined forms and equal finish by almost any other means

It is common practice to place studs on the axes of screw holes normal to the surface to which the casting is to be attached and, if this surface is curved as is usually the case, the axes of the studs or screw holes come at several odd angles. This often precludes the coring of more than one or two holes which may happen to come with axes normal to the die parting, unless the die is provided with separate slides which increase its cost and often are not feasible at all. The alternative for the die caster is to spot the holes, when the design permits, and to drill and usually tap them subsequently. This, of course, is a simple and not very expensive operation, but it usually involves shifting the casting through odd angles on the drill press. If the hole location and the angle of its axis are at all important, the use of a special rocking fixture is required which must be added to tooling cost. If all the holes were parallel, the fixture would cost less and all holes might be drilled simultaneously.

In fastening die castings to sheet metal parts, several alternative types of fastenings deserve consideration. They include: tapped holes in die-cast bosses; cored or drilled holes in die-cast bosses for self-threading studs or screws; studs die cast in place; riveting with separate tubular or solid rivets, or fastening with through screws or bolts; riveting or spinning over of projections forming a part of the casting; use of so-called "speed nuts" on integral projections of the casting provided for the purpose; and use of hooked projections on the casting with a spring clip or other fastening for engaging one or more hooks; and various combinations of these types.



Die cast horn parts one of which carries integral projections which pass through mating holes in the other half and are afterward spun over to fasten the parts together permanently

With proper tools, correctly ground, tapping is very simply and rapidly done. But any self-tappings screws and studs are used with satisfaction, some of them being drive screws and others having standard threads, not necessarily hardened. They can be applied with a screw or stud driver, sometimes in a drill press or its equivalent. Use of studs die cast in place, though often an excellent construction, has the disadvantage of lengthening the casting cycle by a time equal to that for placing the studs in the hot die.

Although the use of separate tubular rivets (as in assembling the Olds six grille, for example) is entirely feasible and may be the best practice, as may be the alternative use of solid or split rivets in certain cases, these methods involve supplying and applying the extra rivets. It is often feasible and sometimes represents a saving, besides avoiding the use of exposed rivet heads, to cast the rivets as a part of the die casting, making the ends hollow or solid, as preferred. Thereafter, on assembly, the integral rivets may be struck or spun over (the metal being quite malleable) to afford a quick and secure fastening without any separate supply or handling of rivets. Often, the projecting integral rivet on a die casting is formed by merely drilling a hole in the die. Projections for speed nuts are similarly formed. Naturally, the location, of the projecting parts must be such that the casting will clear the die. It is often a simple matter to form a small lip on a boss or other projecting part of a die casting—per-

haps a part required for some other purpose—and afterward spin over this lip to assemble the casting to any mating part.

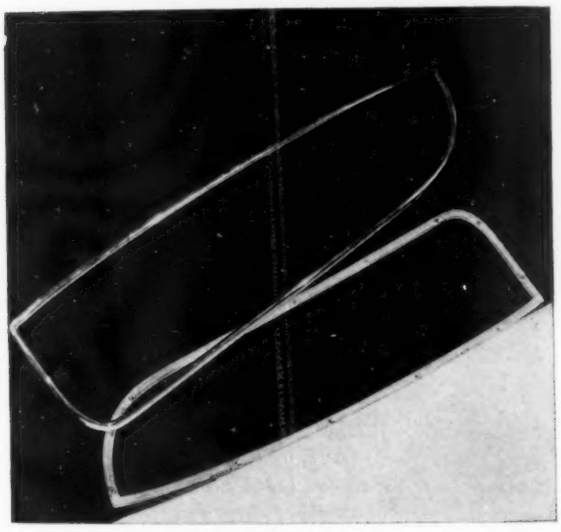
Brackets for Head, Tail and Fender Lamps

The fact that both Ford and Chevrolet, as well as many cars in higher price classes, employ die-cast tail lamp brackets, is perhaps, sufficient indication of their economy and utility. In some cases, as in Buick models, the lamp housing itself is also die cast and there is provision for supporting the license plate. The fact that the die casting lends itself to production in complex forms cored out for light weight and in pleasing contours, often of streamline section is, of course, much in its favor. Fastening means are readily provided and can be concealed, and shapes which it would be difficult or impossible to stamp can be used. Much the same may be said of headlamp brackets, which are die cast on several cars, and it is considered likely that head-lamp bodies may yet be die cast either separately or integral with their supporting brackets. Availability of new finishes suitable for die castings finishes that are highly enduring and possess excellent adherence, and which can be had in colors matching the body, have tended to promote the use of die castings requiring an organic finish, such as the brackets in question.

Frames for die-cast fender lamps are produced in numerous patterns and with attractive decorative effects. Recesses for lenses and other glass parts are readily cored out and very little if any machining is needed. Either plated or organic finishes are readily applied with little or no preparation of the surface.

Castings for Body Interiors

Aside from steering wheel parts already dealt with, there are numerous other die cast parts for body interiors which are deserving of mention. Brackets for attaching steering columns to the body are nearly all die cast and constitute a good example of an important structural use. Cadillac is the only car which has yet employed an instrumental panel which is completely die cast, including the glove-compartment door, but this application is now in its second year and is a good example of a casting unusually long and thin in section. It is cast, of course, with the openings for the glove compartment and instruments and is provided with required fastening lugs. Many other cars have die-cast instrument frames and decorative parts for instrument panels. These include the radio grilles on Olds and Buick models. Several cars in the Chrysler lines have die cast instrument panel frames in which the slides for choke, throttle and switch parts are guided and held flush with the panel.



Dodge grille moldings, excellent examples of light and somewhat flexible moldings employe for decorative purposes. These and some similar moldings are only 1/32 *in. in thickness but have integral bosses for convenient fastening*

When it comes to hardware, exterior as well as interior, die cast parts are practically without competition and give universal satisfaction. Again the matter of appearance and freedom in design, as well as the remarkably smooth finish which is attained today are all in favor of the die casting. Recently it has been possible to produce acceptable hardware parts cast so smooth that even buffing the surface before plating is dispensed with. Now that a satisfactory bright nickel finish has been developed, it is also possible today, nearly if not entirely, to do away with polishing, buffing and coloring operations for most grades of hardware. Ford is continuing the use of some Macoid finish on interior hardware, and this process also does away with polishing and buffing.

Much experimental work has been done, both here and abroad, in the coating of hardware parts produced by die casting with cellulose acetate applied by the injection molding process. This has attained a commercial application in the electric refrigeration field but is not yet used for automobile hardware to the author's knowledge. It permits of extremely attractive finishes, which give promise of good enduring qualities, but it remains to be seen whether it can compete with plating in cost.

Applications in Horn Bodies

Not many years ago, the bells and other parts of horns were largely produced from stamped and drawn parts. Today, both bells and bodies, some with quite intricate spiral passages, are die cast. One important reason for this change is that the die casting is not only less expensive, but, in the case of some designs, is the only feasible method of production. Another reason is that tone qualities are secured with the zinc alloys superior to the stamped sheet formerly used. Although the die cast horn probably weighs more than one built up from stampings, the former are produced with quite thin sections and this saving in production cost is not to be overlooked.

Reference to accompanying illustrations of horn castings show them to be split in the axis of the bell and the spiral leading into it. The mating faces have to make a tight fit and are held together by several screws or bolts, or in some designs by rivets which are made integral with one casting and afterward spun over when the parts are assembled. In such applications, or any others in which the zinc alloy is put under compression by tightening the screws, it is well to remember that the zinc is subject to a certain small creep or cold flow. For this reason, the thickness of bosses should be minimized and it is wise to use a spring washer, as

there is some tendency for screws to loosen. This has caused trouble where precautions against it have not been taken, but with proper design it is not serious, as otherwise die castings could not be used in many automotive applications, such as the horns in questions and fuel pumps, of which many millions are in use.

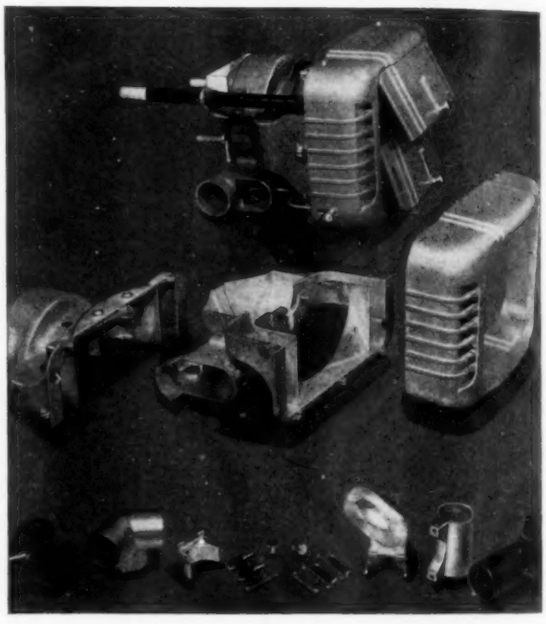
Chassis Applications

A large majority of the applications of die castings to chassis parts are so well known and so much taken for granted as not to require extended comment here. Such parts as carburetor bodies, fuel pumps and filters, lamp brackets, accelerator parts, oil seal rings for crankshaft bearings, distributor brackets, steering column brackets, shifter lever trunions and balls, running board fittings and steering wheel hubs have either been mentioned before or are so commonplace that further mention is not necessary.

Somewhat less common, but of growing importance are such parts as end plates for vacuum brake cylinders and several similar or supplementary castings in vacuum cylinders and housing parts on vacuum-operated gear shifters and clutch actuating elements. The reasons for using die castings in such parts is much the same as for other chassis parts, and so need not be detailed here.

An unique application of die castings developed recently to solve a difficult problem, however, is that in the Bendix-Weiss universal joint. This joint, instead of using the conventional trunion, carries a steel ball between races supported by the yokes of the driving and driven portions. The races are hardened steel and the yokes are steel forgings with splined hubs. To make the races integral with the hubs involved production problems as to make it difficult to compete with joints of more conventional design. It is relatively simple, however, to make the hardened races separately. The problem was to secure them to the yoke in precisely correct position at moderate cost. An excellent solution of the problem was found in the use of zinc alloy die cast in such a way as to form a matrix joining the respective parts. In other words, the yoke and the two races are held in correct relative position in a casting die and the space between and around them is filled with the zinc alloy by the die casting process. As the zinc alloy is in compression, in which it has a strength of at least 60,000 p.s.i. (some zinc alloys run as high as 93,000 p.s.i.) it is understood to meet all requirements, even under heavy overloads, shock loads and low temperatures.

Although this is an unusual application, it may well suggest others in which zinc alloys may be used in combination with other metals employed as inserts to provide properties which the zinc alloy itself cannot meet. As the casting temperature of zinc alloys is under 850 deg. F. and they cool very rapidly in the die, the temperature of inserts is not raised enough to soften a hardened steel part or, in fact, to adversely affect such materials as phenolic plastics, wood, or even compressed paper, all of which are sometimes used as inserts, though not, as far as the writer can recall, in automotive parts. It is a common thing to insert a bronze bushing or an insert of steel in die castings and there is little doubt that, by the intelligent use of inserts, many die castings might be improved or made lighter. There is still plenty of opportunity for the designer to use his ingenuity to advantage along this line.



Well designed car heater in which the main housing and several auxiliary parts are logically made in die-cast form, yielding advantages both in fine appearance and in convenience in mounting and assembly

Finishing

Plated Coatings

No paper on the general subject of die castings in the automotive industry can be considered complete without reference to the subject of finishing. At the present time most finishing on automotive parts is of the plated type. In recent years practically the entire automotive industry has standardized on certain definite specifications for plated coatings on zinc alloy die castings. Assurance has been given by the leaders in the industry that electro deposits satisfying these specifications are giving good service.

It is not necessary to go into detail as to the individual specifications of the various companies. In general, they all require heavy coatings, the minimum varying from 0.0008 to 0.001″. This may be composed of a series of copper, nickel and chromium, or of nickel and chromium, the option being allowed in most cases. Where the sequence is copper-nickel-chromium, the minimum copper thickness is specified variously as 0.0002 and 0.0003″. The nickel deposit is variously specified as a minimum of 0.0003 and 0.0005″. The chromium in most cases is required to be a minimum of 0.00001″, although one large producer requires 0.000025″. It cannot be too strongly emphasized that the satisfaction now being obtained with plated die castings in the automotive industry depends upon the conscientious fulfillment of these specifications.

In addition to the thickness of coating specifications, most automotive concerns also specify some type of quality test such as salt spray or contact with hydrogen sulphide. Tests of this type are intended to detect major deficiencies in plating quality.

One cannot leave the subject of plating specifications without calling specific attention to the fact that they are based on definite experimental and service evidence compiled by a number of capable workers in the industry, and they are not figments of imagination, but definite operating limits based on experience.

Organic Finishing

With the exception of the use of color as a contrast for chromium plate in ornamental parts, not many automotive die castings are subjected to organic finishing. The details of the procedures used in specific instances are not available. It is definitely known, however, that at least one finishing system calls for the use of a suitable primer over which either an air drying or baking finish may be applied. Other systems on which experimental evidence is now available permit the application directly of baking enamels on the zinc alloy die castings. In this system the die castings are pretreated in a phosphate type solution. This pretreatment makes it possible to select the desired finish on the basis of color matching, coating properties, etc., without consideration as to its applicability to zinc.

Notes and Suggestions on Design

In the foregoing comments on current applications there are indicated or implied numerous "do's and don'ts" which the designer should observe for optimum results with die castings.

As in other types of castings, both inner and outer corners and edges should have fillets; the larger the better. Although sharp corners can be cast, they often if not always tend to disrupt the smooth flow of metal and are likely to result in defects. These may include increased porosity and surface blemishes productive of much trouble in finishing and resulting in much more numerous rejects, often after considerable time has been spent in polishing and plating. When, for aesthetic reasons, the stylists insist on sharp edges, even a very small fillet, hardly visible except on close inspection, may help materially. Omission of fillets often results also in breakage otherwise avoided, and also make polishing and buffing more difficult. Plating is also adversely affected.

Where buffing is required on any surface of the casting, as it usually is before plating, the designer should try to visualize the position the casting must assume relative to the wheel and so design the surfaces that they are reached readily by the buffing wheel. Depressions, when required should, so far as possible, lie parallel to the direction of motion of the casting in reference to the wheel, should be as shallow as conditions permit and should have sweeping fillets where the depression merges with other surfaces. Ribs or beading likewise should be parallel with the normal motion of the casting against the polishing wheel and have liberal fillets where they join other surfaces. Convex surfaces are usually much easier to buff than concave ones. A surface of rotation is usually easy to polish if not interrupted by projecting parts. Thus, a circular steering wheel hub is readily polished on a rotating fixture, but if its surface were interrupted by projecting spokes the buffing would obviously be more difficult.

Large plain flat surfaces should be avoided if exposed to view in service. They are likely to be wavy or to have blemishes which are not easy to remove. Even slightly crowned surfaces may tend to avoid such defects, especially as they give concentrated highlights when plated and polished. Stepped or relieved surfaces, or well rounded beads or bands of beads, often improve appearances greatly and tend to mask defects, of no consequence structurally, but tending to stand out prominently on a flat surface. The casing of the car heater here illustrated is an example of good design including well rounded corners and the use of steps and beading in such a way as to enhance appearance without departure from simple and attractive forms. Incidentally, when constructing a die for a part of this kind, it is often much better to work from a dummy or model than from a drawing in which the curves have to be defined geometrically. Where fastenings or other locating parts are to be held within close limits, of course, these dimensions are better located from a drawing.

Sudden changes in section thickness should be avoided, so far as possible, but where not avoidable the largest possible fillet should be used or the transition should be made as gradually as possible. Weight can often be saved and stiffness improved by judicious use of ribs and bosses, or reinforcement at fastening points.

Perhaps there is no general rule so frequently stated or so often overlooked as that of consulting the die caster fully, and as early in the design as possible. It need hardly be added, perhaps, that the metal suppliers are always ready to assist in such matters as fall within their province and to give their opinions, after suitable research, when this is required, as to performance under given conditions, especially when these are unusual. There is, of course, a great wealth of accumulated experience with die castings with which both the metal supplier and the competent die caster is familiar, and either is ready to share this with those having a legitimate interest in profiting by it.

Commercial Standard for Mirrors

The National Bureau of Standards, Washington, D. C., has just released a second edition of its Commercial Standard CS27-36, for mirrors. The first edition of this commercial standard, entitled Plate Glass Mirrors, was published in 1930. The revised standard covers plate-glass mirrors and "shock" or common window-glass mirrors. Plate-glass mirrors are of three distinct grades designated as "A," No. 1, and No. 2 quality, based on the presence of certain defects which generally occur in existing grades of plate glass. Shock or common window-glass mirrors are manufactured in one quality only, based upon defects found in window glass. They are available in single strength, double strength, and heavy window glass. The standard covers thicknesses, silvering, quality designation, guarantee, and method of inspection.

Experience of the industry under the provisions of the first edition of this standard indicated the desirability of eliminating AA and No. 3 quality plate-glass mirrors.

The first edition covered plate-glass mirrors only, while the second edition was extended to include "shock" or common window-glass mirrors.

The revised standard became effective for new production on August 20, 1936. Copies are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each.

Foundrymen's Convention

Non-ferrous sessions will include bronze founding, cupro-nickel, X-rays, and control of sand mixtures.

EXECUTIVES and key men of companies manufacturing brass, bronze, aluminum and other non-ferrous metal castings, are looking forward toward attending the Forty-First Annual Convention and Foundry Show of the American Foundrymen's Association which will be held in the Milwaukee Auditorium, Milwaukee, Wis., May 3 to 7.

Problems of management will feature the program of the convention with a full complement of interesting practical papers on foundry practice and technique. Executives will be interested in such subjects as apprentice and foreman training, job evaluation, safety methods, costs and safety and hygiene in the foundry. Leaders in their respective fields will discuss these subjects and give valuable information that can be used in the solution of many problems that face foundry executives daily.

Some of the subjects to be discussed at the convention sessions for non-ferrous foundry operators include bronze founding, methods used for casting 30 per cent cupro-nickel, the use of x-rays to control and improve production methods, recommended practices and methods and results obtained from the control of sand mixtures in non-ferrous foundries. These and other interesting subjects will be discussed by men who through exceptional experience are qualified to speak on the various subjects. There will also be a number of general interest sessions such as those on sand research, the shop operation courses and round-table luncheon and discussion which has been so popular in other years.

The plant visitation program will offer opportunities to visiting executives and key men to inspect the non-ferrous casting plants in the Milwaukee area. In general, the Milwaukee foundries are recognized widely for the excellence of operation and for their progressive methods of production. Good Housekeeping is the by-word and the rule in Milwaukee foundries. This phase of the foundry business is becoming more important as time passes and the plant visitation program offers an opportunity for observation of this phase of foundry management in a section of the country that has had considerable experience with such problems.

Brilliant night scene in Milwaukee featuring Mariner Tower

The schedule of events applying particularly to the non-ferrous interests are:

MONDAY, MAY 3.

A.M. Plant visitation.

P.M. Opening of Exhibition of Foundry Equipment and Supplies.

Sand Control Shop Course (session No. 1).

TUESDAY, MAY 4.

A.M. Foundry Show.
Sand Control Shop Course (session No. 2).
Job Evaluation — Technical session.

P.M. Stag dinner and entertainment, under auspices of A.F.A., F.E.M.A. and Milwaukee Chapter of A.F.A.

WEDNESDAY, MAY 5.

A.M. Foundry Show.
Apprentice Training—Technical session.
Sand Research — Technical session.

P.M. Foundry Costs — Technical session.

Evening Safety Methods and Good Housekeeping — Technical session.

THURSDAY, MAY 6.

A.M. Foundry Show.
Sand Control Shop Course (session No. 3).
Non-Ferrous Foundry Problems—Technical session.
Insurance and Occupational Disease Laws.

P.M. Non-Ferrous luncheon and Round-Table discussion.
Refractories—Technical session.

Evening Annual Banquet—A.F.A.

FRIDAY, MAY 7.

A.M. Foundry Show.
Non-Ferrous Foundry Sand Control — Technical session.

P.M. Plant Visitation.

Among the papers to be read will be the following:

Practical Applications of Sand Control in Non-Ferrous Foundries, A. C. Arbogast, Northern Indiana Brass Co., Elkhart, Ind.

Some Fundamentals in Non-Ferrous Sand Control, G. K. Eggleston, Detroit Lubricator Co., Detroit, Mich.

A Study of Non-Ferrous Sands, H. W. Dietert, H. W. Dietert Co., Detroit

Division Business Meeting.

Casting 30% Cupro-Nickel, T. E. Kihlgren, International Nickel Co., Bayonne, N. J.

X-Ray as an Aid in the production of Aluminum Castings, Geo. Stoll, Bendix Corp., South Bend, Ind.

Problems in Bronze, Harold J. Roast, Canadian Bronze Co., Ltd., Montreal, Canada.

Report of Committee on Analysis of Defects, H. M. St. John, Detroit Lubricator Co., Detroit, Mich.

Report of Committee on Recommended Practices, H. J. Rowe, Aluminum Co. of America, Cleveland, O.

Plans for the exhibition of foundry equipment and supplies in connection with the A.F.A. Convention in Milwaukee, May 3 to 7, indicate a record breaking display.

With more than seventy-five classifications of machines and materials presented by nearly two hundred firms, a greater variety of interest will be offered than at any previous show held in connection with the annual meeting of the association. In number of exhibits, the show will exceed the Detroit exhibition held in 1936. Although the facilities available have limited to some extent the size of a few individual displays, the total space occupied will be greater than in 1918 and 1924, the two previous years when foundry exhibitions were held in Milwaukee.

The complete facilities of the Milwaukee Auditorium will be utilized. The latter will be devoted to operating exhibits demonstrating the practical use of various types of machinery. Particular attention is being given by exhibitors this year to setting forth operating economies in molding, coremaking, melting, handling and conveying, and cleaning operations. Emphasis also is placed upon plant housekeeping, ventilating, lighting, and all those factors contributing to make the individual foundry a more attractive place in which to work.

Testing of Metals and Plating

Corrosion testing; copper and copper alloys; die cast metals; light metals; effect of temperature on metals; fatigue; exposure tests of plating on non-ferrous metals.

AT the large number of meetings of standing committees of the American Society for Testing Materials held in Chicago at The Palmer House, during Committee Week, March 1-4, a number of new specifications and tests were approved and will be submitted to the Society at the annual meeting in June, subject to approval by confirming letter ballot of the respective committees. There were about 150 meetings throughout the week including main standing committees, sections and subcommittees.

The total registration for Committee Week was about 600. All of the meetings were very well attended and spirited discussion took place at several of them on important points.

The following committees were among those holding meetings:

B-1 on Copper and Copper Alloy Wires for Electrical Conductors,

B-3 Sub VI on Atmospheric Corrosion of Non-Ferrous Metals and Alloys,

B-5 Sub I on Wrought Metals and Alloys,

B-6 on Die-Cast Metals and Alloys,

B-7 on Light Metals and Alloys,

Joint Committee on Exposure Tests of Plating on the Non-Ferrous Metals.

Corrosion Testing Procedure

DR. F. N. SPELLER, of the National Tube Co., headed the committee which developed the papers in the corrosion testing symposium.

The six papers in the corrosion symposium were as follows:

"*Principles of Corrosion Testing*," by C. W. BORGMAN, National Tube Co., and R. B. Mears, Aluminum Company of America.

"*Atmospheric Corrosion Testing*," by H. S. RAWDON, Chief, Division of Metallurgy, National Bureau of Standards.

"*Salt Spray Testing*," by E. H. DIX, JR., Chief Metallurgist, Aluminum Research Laboratories, Aluminum Company of America, and J. J. BOWMAN, Metallurgical Division, Aluminum Research Laboratories, Aluminum Company of America.

"*Alternate Immersion and Water-Line Tests*," by D. K. CRAMPTON, Research Director, Chase Brass and Copper Co., Inc.

Wrought Copper and Copper Alloys

The Subcommittee on Wrought Metals and Alloys of A.S.T.M. Committee B-5 on Copper and Copper Alloys, Cast and Wrought, considered in detail two proposed tentative specifications, one for rolled non-ferrous bearing plates for bridge and other structural uses, and the second covering seamless condenser tubes and ferrule stock. It is planned to submit these specifications to Committee B-5 shortly for consideration for publication as tentative.

Die-Cast Metals and Alloys

Committee B-6 on Die-Cast Metals and Alloys decided to expand its present extensive corrosion test program to include indoor and outdoor exposure tests on three magnesium-base alloys.

The subcommittee on tin and lead-base die-casting alloys perfected plans to undertake extensive series of tests on five lead and tin-base die casting alloys which are representative of American practice.

The committee plans to recommend a revision of the Specifications for Aluminum-Base Alloy Die Castings (B 85-33 T). This change will include the insertion of Alloy No. XI and informative data concerning its properties will be included in the

table appended to the specifications. This alloy has a nominal composition of 2 per cent copper, 8 per cent silicon, 1.5 to 2.0 per cent iron, 0.05 max. manganese, 0.05 max. magnesium, with aluminum the remainder.

The committee reviewed the work in progress on endurance tests and creep tests on both aluminum and zinc-base die castings.

Light Metals and Alloys, Cast and Wrought

A.S.T.M. Committee B-7 on Light Metals and Alloys has been very active during the past year through its various subcommittees. At the meeting of Committee B-7 in Chicago during Committee Week the Subcommittee on Aluminum and Aluminum Alloy Ingots completed extensive revisions of the Tentative Specifications for Aluminum-Base Sand-Casting Alloys in Ingot Form (B 58-33 T). This subcommittee is preparing specifications for aluminum ingots for permanent mold castings which will be in the nature of companion specifications to the Tentative Specifications for Aluminum-Base Alloy Permanent Mold Castings (B 108-36 T), completed last year by the committee and issued as an A.S T.M. tentative standard. The subgroup is also reviewing a tentative draft of specifications for aluminum-alloy ingots for die castings.

Exposure Tests of Plating on Non-Ferrous Metals

About 75 persons attended the conference of the Joint Committee on Exposure Tests of Plating on Non-Ferrous Metals held during A.S.T.M. Committee Week in Chicago, March 1-4. Dr. William Blum, chairman of the committee, presided. Data giving the results of exposure tests to date were distributed and discussed, and it was agreed that the present system of rating on a numerical scale furnished a good basis for comparison of the coatings.

The effects of cleaning and protecting the plated surfaces with grease or wax were illustrated by actual specimens from the racks in New York. It was decided to expose new specimens of about 30 typical sets to which the cleaning and protective films would be applied at the start and at regular intervals thereafter.

It was also recommended that some new sets with different methods of preparation and thickness of coating be prepared and installed as soon as feasible. It was decided that pending the results of these supplementary tests no conclusions from the research should be published.

The use of color photography for recording exposure tests was demonstrated by C. E. Vincent-Daviss. The results were of interest and value, although no entirely satisfactory way has yet been found for photographing bright surfaces without getting the color of the sky or other reflected surfaces.

Following the general conference, the Joint Committee met and discussed details at the supplemental tests, to be initiated as soon as practicable.

British Metallurgists Discuss Alloying, Rolling and Testing

Papers read on metal spraying, aluminum, zinc, brass, bronzes, magnesium and others

THE Twenty-ninth Annual General Meeting of the Institute of Metals of Great Britain, was held in London on March 10 and 11, 1937. The President, W. R. Barclay, was in the Chair. The Secretary presented the Report of Council for the past year.

The Secretary announced the election of the following officers for the year 1937-1938:

President: W. R. Barclay.

Vice-presidents: Engineer Vice-Admiral Sir Robert Dixon. Lieutenant-Colonel R. M. Preston.

Members of Council: W. T. Griffiths, Stanley Robson, A. J. G. Smout, D. Stockdale.

Synopses of some of the papers read are given below:

Synopses of Papers

Metal Spraying; Processes and Some Characteristics of the Deposits, by E. C. Rollason.

Spraying pistols using wire, powder, and molten metal are described, together with comparative details. The nature of the sprayed deposit is discussed. A few corrosion tests, using intermittent salt-spray have been made on zinc and aluminum deposits and on painted zinc coats.

Using the three types of pistol, comparative tests of aluminized surfaces have been made and heat-treated nickel-chrominum-iron coatings were found to have good resistance to oxidation at elevated temperatures. Data are also given for porosity, oxide content of sprayed copper, and hardness of sprayed metals.

The Effect of Cast Structure on the Rolling Properties of Zinc, by L. Northcott.

Preliminary work on zinc of 99.99 per cent, purity showed that the casting temperature of ingots cast by the Durville method has little effect on the structure, density, tensile strength, notched-bar impact value, or rolling properties.

The examination of ingots made by utilizing directional solidification showed that the directional properties of the zinc crystals are such that in columnar form the strength measured in the direction of growth is about four times that at right angles to it. Less pronounced differences were observed in the notched-bar impact values. The selective weakness of the metal along one set of crystal planes was also demonstrated by the tearing action of the cutting tool when machining in certain directions, and resulted in the development of a number of surface cracks.

An account is also given of the conditions under which zinc ingots can be initially rolled during cooling after casting; satisfactory strip was obtainable provided the temperature of the ingot at the commencement of rolling was within the range 350°-100° C., which, when 16 lb. ingots were used, entailed an interval of from 2¼ minutes to 1 hr. after the completion of solidification.

An Aluminum Statue of 1893: Gilbert's "Eros", by Professor R. S. Hutton and Dr. Richard Seligman.

The freedom from serious corrosion of the "Eros" statue in Piccadilly Circus, London, after 38 years' exposure and the fact that it is made of unalloyed aluminum are recorded. Whether the metal used in 1893 was produced by the old chemical or new

electrolytic process is undecided, but the results of analyses of specified examples of old aluminum are reported.

Directional Properties in Rolled Brass Strip, by MAURICE COOK.

The tensile properties of brass strip in directions parallel, normal and at 45° to the rolling direction, have been determined after progressively increasing rolling reductions up to more than 90 per cent. When the rolling reduction has been sufficient to induce a directional effect the greatest strength and least ductility are obtained normal to the rolling direction, while the converse obtains in the rolling direction.

When cold-rolled brass strip is finally annealed, it may show directionality which is revealed both by tensile tests and by the occurrence of ears or waves on the edges of cups cut from the strip. In annealed strip showing directionality, the tensile strength is least and the ductility greatest at 45° to the rolling direction, and it is in this position that ears are formed. The extent to which directionality exists in rolled and annealed strip is largely determined by the conditions of the penultimate and final annealings and by the magnitude of the rolling reduction between these two annealings.

A study of the orientation of twinning planes in rolled and annealed 70 : 30 brass strip showing appreciable directionality in tensile properties and in the tendency to form ears on cups, indicates that the frequency of orientation of the twinning planes is lowest at about 45° to the direction of rolling. The direction of maximum frequency of orientation of twinning planes appears to be fortuitous in strip not showing directionality in other respects.

The Resistance of Some Special Bronzes to Fatigue and Corrosion-Fatigue, by H. J. GOUGH and D. G. SOPWITH.

Fatigue and corrosion-fatigue tests on four types of special bronzes have been carried out to ascertain the suitability of these materials for special aircraft purposes. The materials tested were: phosphor-bronze, aluminum bronze (10 per cent aluminum), beryllium bronze (2.25 per cent, beryllium), and Superston L189 bronze. The results show that the corrosion-fatigue resistance of the bronzes compare favorably with that of stainless steels, the beryllium bronze in particular having the highest corrosion-fatigue resistance of any material so far investigated by the authors. The fatigue resistance in air of Superston is exceptionally high for a non-ferrous material, but the material appears to be highly susceptible to stress-concentration effects.

The other papers read were the following:

The Theory of Age-Hardening, by DR. MARIE L. V. GAYLER.

The Effect of the Addition of Small Percentages of Iron and Silicon to a High-purity 4 per cent Copper-Aluminum Alloy, by DR. MARIE L. V. GAYLER.

Stress-Strain Characteristics of Copper, Silver and Gold, by J. MCKEOWN and O. F. HUDSON.

Creep of Lead and Lead Alloys. Part I.—Creep of Virgin Lead, by J. MCKEOWN.

A Study in the Metallography and Mechanical Properties of Lead, by BRINLEY JONES.

The Control of Composition in the Application of the Debye-Scherrer Method of X-ray Crystal Analysis to the Study of Alloys, by W. HUME-ROTHERY and P. W. REYNOLDS.

The Solubility of Silver and Gold in Solid Magnesium, by W. HUME-ROTHERY and EWART BUTCHERS.

Alloys of Magnesium. Part V.—The Constitution of the Magnesium-Rich Alloys of Magnesium and Cerium, by J. L. HAUGHTON and T. H. SCHOFIELD.

Steel Bluing

Q.—My firm is a subscriber to METAL INDUSTRY. We have many calls for bluing pistols, shotguns and rifles.

I noticed in your October 1935 METAL INDUSTRY under "Shop Problems," T. H. C., problem No. 5425, a formula published which stated: Take equal parts sodium nitrate and potassium nitrate in a cast iron or steel pot at 600° F.—Manganese added in ratio, one part oxide to 50 parts nitre.

We have clean pots and polish all articles as in nickel plating. We followed the formula to the best of our knowledge, but we still have trouble with spots appearing on articles. We would like to know what causes this. We have tried using several different kinds of oil previous to submerging it in the molten metal. I would like to know which is the best oil you recommend. We have also tried different temperatures of heat. Some articles come out good and others are spotted. Would appreciate if you would advise me at your earliest convenience the best method to proceed.

Will you also please explain how the oxidized finish is obtained on shotguns which look like a blue and golden yellow color.

A.—The bluing of steel is nothing more than obtaining a uniformly colored oxide film on its surface. If the steel part is left in bluing bath too long, a non-uniform color will result.

Preliminary cleaning in gasoline or other similar solvent produces a mottled dirty finish. Parts should be thoroughly cleaned of all adhering grease or dirt with an alkali cleaner. After articles have been cleaned and thoroughly dried, apply a thin coating of oil and then immerse in nitre bath at 600-650 deg. F. After the right blue is obtained, the parts are quenched in cold clean water to strike the color, then immersed in boiling water and finally in hot oil.

It is necessary to have bath free of iron oxide or otherwise a mottled finish will be obtained. The surface of parts to be blued should also be free of iron oxide. If manganese dioxide is used in bath, it should be replaced at the rate of 1 lb. every 3 hours to a 300 lb. bath of nitre to keep bath in condition.

A light paraffin oil should be used for oiling parts prior to bluing. An oil with viscosity of about 100 seconds, at 100 deg. F. is satisfactory.

If the surface of the steel to be blued is not prepared properly an unsatisfactory finish will be obtained. Clean surface, free of oil, dirt and grease, dry thoroughly before apptying oil film prior to bluing, keep nitre bath to strength and free of iron oxide, satisfactory results should be obtained consistently.

In the polishing of the steel surface, precautions should be taken to prevent overheating or burning as this will cause spotting of final finish. Some types of steel will not blue easily due to their composition. On straight carbon steels with either low or high carbon content a blue oxide film is most easily obtained. Alloy steels are difficult to blue.—T. H. C.

Some Rolling, Polishing and Buffing Methods

Practical methods of surfacing metal products used in a large manufacturing plant.

By JOSEPH P. SEXTON

Head, Finishing Department, Sargent & Co., New Haven, Conn.

ONE cannot very well tell of polishing and buffing methods on iron, brass, and bronze without first mentioning something regarding the rolling of these metals.

Rolling

A great many articles are rolled to prepare the surface for further finishing instead of polishing, and occasionally for production and economic reasons, more are added to the list. Very good results are obtained on most of these articles, especially the ones which, due to their contour and shape, lend themselves to the operation without danger of rounding edges or corners.

The cast iron articles are rolled in horizontal iron barrels using sea-sand and water. The barrels are well filled, rotating 50 R.P.M., and roll from 48 to 72 hours depending on the finish desired and taking into consideration the condition of the castings. In order to obtain the proper surfaces on curves, recesses, etc., and insure a better rolling job in general, it is very important to mix articles of different sizes and shapes together. I might add that we haxe experimented considerably using other abrasives and oil instead of water, but the increased cost of the materials and the finish produced dissuaded us from changing.

After sand rolling, the work is rinsed and dried, and then bright rolled from 4 to 8 hours in wooden barrels using scrap leather, leather meal, and sometimes jacks which are added to help the rolling on irregular shaped articles. Burnish rolling may be used instead, but we favor the dry rolling on cast iron articles.

Wrought parts, such as rivets, screw blanks, etc., which are rolled to remove burrs and make a smoother surface, are put in angle iron barrels and rolled from 12 to 15 hours in sea-sand and water.

Cast brass and bronze castings are sand rolled like the iron, but a soft sand is mixed with the sea-sand.

Nearly all steel articles which will permit are burnished rolled in wood lined barrels using steel balls of different sizes and a good grade of soap powder. The work is rolled from 45 to 60 minutes, excepting a few articles which have an annealing scale and require a longer period of time. A very satisfactory job is obtained in this manner, without the addition of cyanide or other ingredients. Many brass and bronze articles which have been sand rolled and dipped, and which, due to their classification do not require polishing or buffing, are given a very good finish by this method. A little powdered soap bark and cream of tartar substitute are added, and 35 to 40 R.P.M. used.

Polishing

The polishing of metals is determined by the finish desired and by the purpose or function of the individual article or part. Parts that are ground for size are usually done on a solid wheel using 36 grain although some brass and bronze parts have a second operation using a finer grain. A few articles which require a smooth, even surface without any stop marks, etc., are polished on a belt using a 46 grain. Cast iron articles which are plated are generally polished on 54, 80, and 100 grain for sanded finishes, and a 120 or 150 added when brighter finishes are required, such as, nickel, brass and bronze plate.

Cast brass and bronze are generally polished on 80, 100, 120 grease, 140 or 180 for all buffed finishes. Wrought

Polishing Knives

brass and bronze are generally polished on 100, 120 grease, or 150. It is generally necessary to remove burrs, stock marks, etc., on these goods.

Some articles due to their shape require strapping where the polishing wheel does not reach and other articles with rounded or curved shapes are polished on what we term a rag wheel, made up of 14″ buffing wheels, using 100 and 120 grains. It is also necessary on some articles, such as, hinge knuckles, etc., to shape the wheel to conform to the contour of the articles. This is true of iron, brass and bronze. Rubber and felt wheels are also used on certain designs and beveled surfaces to take care of corners, raised parts, etc. without spoiling other sections of the surface.

Nearly all brass and bronze articles that are polished for plated or lacquered finishes are buffed. However, on a good many finishes, especially the dull and oxidized ones, a dry scouring, as we term it, using a greaseless compound, can be substituted to very good advantage. This operation is faster, requires less skill, and saves considerable time and labor.

Buffing

The buffing usually consists of a cut down and a coloring operation, but again on some finishes the coloring can be omitted. The cutting down is usually done on a 12″ or 14″ wheel, depending on the articles, about 2500 R.P.M., with a good grade of tripoli.

This gives some idea of the sequence of operations and the performance of same. For proper results we cannot overlook the general condition of the articles handled, the materials and their application, condition of the equipment, and, of course, the operator.

Moisture Permeability of Aircraft Finishes

The resistance to moisture penetration of a protective coating is recognized as a fundamental property of practical importance in the prevention of intimate contact of the metal with this deteriorating agent. The problem of protecting the metal is not merely one of waterproofing, since a sound coating does not normally allow the passage of water by diffusion through holes or capillary spaces. The film behaves rather as a typical colloidal, permeable membrane, adsorbing water and transmitting it through the film by a process of chemical diffusion. In RP974 in the February number of the Journal of Research, Gordon M. Kline presents the results of a study of the permeability to moisture and some related properties of various finishes used by the Navy Department on aircraft.

The glyceryl-phthalate enamels are less permeable to moisture under relatively dry conditions than are the enamels made with a phenol-formaldehyde resin; this order is reversed, however, under wet conditions. This corresponds with the service uses to which these finishes have been found to be best adapted. The aircraft finish made with a cellulose nitrate base is very permeable to water vapor under both wet and dry conditions. It was found that the permeability is not directly proportional to the vapor pressure difference. The rate of passage of moisture per unit pressure difference increases with rising temperature. A given type of finish in contact respectively with liquid water and with air saturated with water transmits moisture at equal rates. The mechanism of penetration is, therefore, probably the same in both of the cases.

Studies have shown that waxes are among the least permeable to moisture of various coating materials. The effect of carnauba wax on the permeability to moisture of films of aircraft finishes was determined in the course of the present study. The application of a coating of carnauba wax approximately 0.4 mil thick to films of 2 to 3 mils thickness has an effect on the permeability to moisture equivalent to the doubling the thickness of the film.

Some observations were made on the permeability to moisture of gas-cell fabrics which had been previously tested for moisture absorption. It was found that the fabrics which contain less gelatin than the standard lightweight fabrics were less permeable in practically every test than the standard material. The permeability also decreases as the amount of paraffin is increased. Insofar as the effects of temperature and relative humidity on the rate of transmission of moisture through gas-cell fabrics are concerned, the directions of the changes are the same as with paint films.

Anodizing Aluminum Alloys in Chromic Acid Solutions

Some of the strong aluminum alloys of the type known as duralumin are susceptible to corrosive attack in the saline atmospheres found near the seacoast. Protection against this attack can be obtained by using the alloy as the anode in an electrolytic bath consisting of a solution of chromic acid. By this reaction, an oxide coating is formed on the anode, in contrast to the metal deposit produced on the cathode in electroplating. R. W. Buzzard, in the Bureau's Metallurgical Division, found that a definite succession or cycle of voltages was required to produce the best coating in 3-percent chromic acid solution. This cycle necessitated discontinuous operation of the bath. As explained in RP975 in the March number of the Journal of Research, a marked improvement was obtained by increasing the chromic acid content from 3 percent, the usual concentration to 5 or 10 percent. The coatings produced were superior in their corrosion resistance and the conditions of operation were simplified so that continuous operation was possible.

The Preparation of the Polishing Wheel*

(*a*) *The polishing wheel must be in balance.*

The polishing wheel should always be put in balance before use to avoid bumping and excessive dressing. This will give longer wheel life, a better finish on the metal and less wear and tear on the polishing machine itself. The wheel bushing should be a good fit on the machine spindle in order that the wheel will run perfectly true.

(*b*) *The wheel should be true.*

To true the wheel, remove the grain and glue with an abrasive brick or the end of a one-inch pipe. After this is done, the face of the wheel should be put in truth with a sharp tool. A tool suitable for this work can be made from an old file.

* From Facts About Metal Polishing, Norton Co.

Brightness of Electrodeposits and its Measurement

Experiments to obtain a definite evaluation of "brightness," just as hardness is expressed by the Brinell figure.[1]

By Dr. B. EGEBERG and N. E. PROMISEL

International Silver Co., Meriden, Conn.

WHEN electro-depositors discuss and compare notes on the "brightness" of their respective electro-plates, it is often realized at a later date that false impressions have been created. The situation is more or less the same as that created by "bright annealing," which preceded "bright electro-plating" by some ten years. What the one called bright, the other called dull, all depending upon the requirements and standards of the various industries. A nickel plate which rightly may be termed bright in a factory engaged in the plating of roller skates, may also rightly be termed dull in a factory producing better finished goods of the gift-shop character. Further, zinc and tin plates which are termed bright in their respective industries are likely to be classed as dull by a person engaged in bright nickel plating. Under these conditions the term "brightness" becomes most confusing.

No Definition of Brightness

Electro-platers have, therefore, in time become cautious and they do not accept the statements of someone else, however sweeping they may be, unless substantiated by a sample of the deposit in the condition as taken from the plating vat. Such comparison of brightness is naturally most cumbersome. It is also inaccurate since samples deteriorate because of tarnish and scratching. They also change character due to handling and rubbing and are often not at hand when required. It is, therefore, highly desirable that a more definite and convenient way for comparing and expressing brightness be established.

Various ways and means have been suggested in the literature for evaluating a property of metal surfaces termed reflectivity and brightness. When such evaluation was made on a series of deposits, the results were contrary to sound judgment from the electro-platers' viewpoint. The property being measured was evidently something different from what the electro-plater terms brightness. We were greatly misled at first by the definition of brightness in terms of physical optics. Here, brightness involves the intensity of reflected light. To the physicist, polished silver is brighter than polished nickel because the intensity of light reflected from the former is greater. To the electro-plater, the brightness of the above two samples would be equal. From the above it may be inferred that brightness in the terms of the electro-plater is something different than that defined by physical optics and that any successful method for determining brightness in the electro-platers' sense of the word must be liberated from the color and from the total reflectance properties of the metals.

What is then the platers' definition of brightness? To him, brightness in the extreme case has a definite meaning of gloss, of clear and mirror-like reflection, and of freedom from haze, fog, cloud and scum of any kind, all judged by visual observation. No method seemed as yet available for expressing this impression of a psycho-physical nature in exact form.

It is from the above considerations that the present investigation[1], the results of which are very briefly described in this paper, has sprung. It deals with studies and experiments aiming at expressing the brightness of electro-deposits by a curve or by a figure easily obtained, which would mean as much as, for example, the figure for hardness of metals obtained by the Brinell machine.

Experimental Procedure

In studying this problem, six flat samples of silver electro-deposits were prepared, ranging in brightness from a very bright, polished specimen to a very dull sample plated heavily in a solution containing no brightening addition. These samples were evaluated by eye according to the platers' method and were then subjected to a variety of tests in an attempt to arrange them in the same order. It seemed that any arbitrary method would be permissible as long as it arranged the mentioned set of samples—and any other set of samples—in the same order as one did visually. Further, the sensitivity of the method should be at least as great as the eye so that those small and next-to-imaginary differences in brightness, which platers of highly finished goods are often called upon to judge, are plainly brought out by the method. Finally, since the visual judgment of brightness is independent of the color and of the total reflectance properties of the specific metals, the method must likewise be independent of these factors. In other words, a certain and equal amount of fog, as judged by eye on, for example, a chrome and a nickel plate, should properly be evaluated by one and the same figure.

A good many methods were tried and found unsuccessful. These we have covered in some detail in the original paper presented at the Convention (see footnote) and will be omitted in the present abstract. However, a few points of interest developed in these first experiments which contributed to the final solution of the problem, and so these will be outlined here.

First of all, when a beam of light

[1]This article is a simplified abstract of a paper presented by the authors at the First International Conference on Electrodeposition held in London, March 2nd and 3rd, 1937.

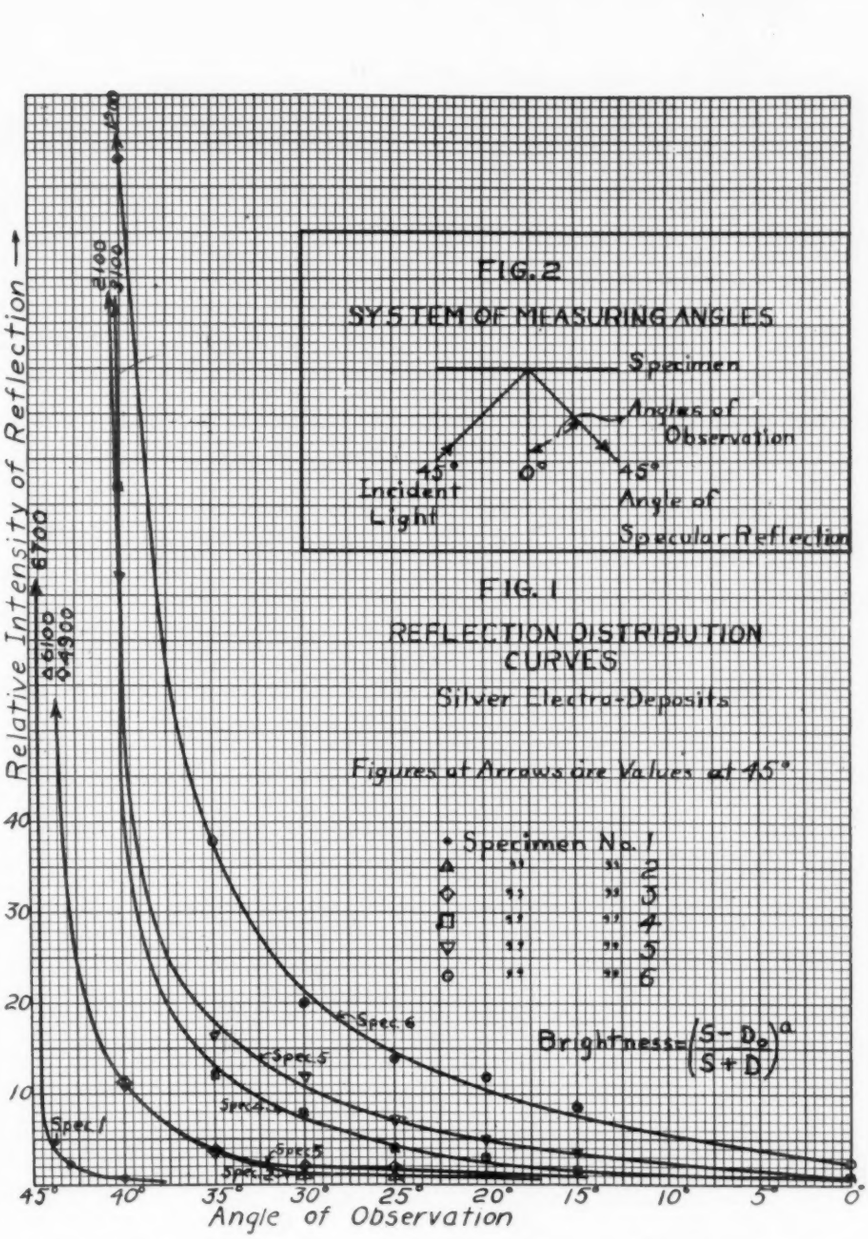
strikes a flat, smooth metallic surface at a certain angle, the greater part of it is reflected back, the exact percentage being termed the "total reflectance" of that surface. If this reflection takes place at only one angle, in this case at the angle at which the beam reached the specimen, it is called "specular reflectance." If however, the light is reflected over a range of angles, it is called "diffuse." The sum of the specular and diffuse reflectance is of course the total reflectance.

Analyzing Reflectance

Among other things, experiments with the series of silver electrodeposits described above indicated that the total reflectance was practically constant, regardless of the brightness or dullness of the specimen. The next step was therefore to consider the two components, the specular and the diffuse. *A priori*, the measurement of either would seem to be satisfactory since, knowing one of them, the other is also known because their sum is essentially constant in this case. Specular reflections being more prominent, however, and more easily and conveniently measured, this was done first. The results showed that only when great differences in "brightness" existed did specular reflection serve as a satisfactory measure of that brightness. Presumably the difficulty lay in measuring the small percentage changes that existed in a property of a relatively high value. On the other hand, changes of the same order in diffuse reflection, values of which are relatively small, would appear easily distinguishable and accordingly this component was next considered. It was at once apparent from the results that diffuse reflections were more important in evaluating "brightness" than any other single property. Furthermore, it was soon evident that the complete evaluation was not satisfactorily made unless both specular and diffuse reflections were simultaneously considered. A method based on this fact was finally adopted, and although other methods were also tried (as described in our original paper), only the adopted one gave consistently satisfactory results.

Equipment Required

The scheme of our apparatus is most readily understood by referring



Figs. 1 and 2. System of measuring angles and reflection distribution curves

to Fig. 2. A narrow beam of light is passed through an appropriate lens system to make the rays as parallel as possible. The beam originates from a concentrated filament lamp, operated from a storage battery in such a way that its intensity is kept constant. It passes horizontally to the specimen, vertically mounted at the center of a circular stage, striking it at an angle of 45°. (Other angles may be used). In the same horizontal plane as the light beam, and perpendicular to the specimen, is an arm, pivoted about the center of the stage. On the arm is placed a light-measuring instrument, so that by rotating the former the intensity of the reflected light can be determined at any desired angle, as illustrated in Fig. 2. Such an outfit is known as a "gonio-photometer."

As a light measuring instrument, several devices were tried. A Weston Photronic cell proved not to be sufficiently sensitive in all cases, although the authors are designing apparatus employing a vacuum tube amplifier that will make the use of photocells very satisfactory and convenient for this purpose. A photographic method was also employed, but tended to be tedious and long drawn out. The best results in the past have been obtained with an instrument such as the Holophane Lightmeter or Macbeth Illuminometer. In such an instrument the light being measured illuminates a small area on a ground glass. Adjacent to this area, the glass is illuminated by a standard electric

lamp, whose distance to the ground glass can be increased or decreased at will, thus decreasing or increasing the illumination on the adjacent area as desired. The distance is in fact varied until, by visual observation, a balance is obtained between both illuminated areas on the ground glass. The value of this distance at balance serves indirectly to measure the intensity of the light beam under consideration.

Measurement Agrees with Visual Inspection

Using the above apparatus, the light reflected from the specimen was measured every 5° from the angle of specular reflection (45°) down to the normal to the specimen (0°). These data are plotted in Fig. 1, where the curves represent the distribution of reflection from the various silver electrodeposits. It will be noticed that all curves have the same general shape. The high value in the neighborhood of specular reflectance drops off more or less rapidly to relatively low values, as the diffuse reflectance is measured at angles more and more removed from the specular angle. Specimen No. 1, the brightest of them all, drops most rapidly and in fact below 40° the reflected light (diffuse, in other words) is negligible. Specimen 6, the dullest of all, drops off least rapidly and shows the greatest amount of diffusely reflected light at all angles down to 0°. Specimens 2 and 3, practically identical in appearance, have practically coincident curves, and the specimens 4 and 5 are intermediate both in appearance to the eye and in regard to the relative positions of their curves. Obviously, we have here, in the relative positions of the curves, a method of evaluating the brightness of electrodeposits in close agreement with visual judgment. It is evident, too, that no single reflection measurement, either at 45° or at 0°, or even combining measurements from both positions, would have correctly described the brightness, except perhaps in special cases. For the general case, the reflection distribution over a wide angle such as chosen is necessary.

In the extreme, especially for specimens showing directional polishing, measurements should possibly be made over a range of angles greater than 45° and repeated after rotating the specimen so that the polishing direction is in a variety of positions. In the samples considered in this paper, the basis metal was so polished prior to plating that, according to experiments, no such rotation was necessary.

In terms of the above, we can now *define brightness* in the electroplaters' sense as *the degree to which specularly reflected light is contaminated with diffusely reflected light.*

Calculations to Obtain a Scale

To make possible a kind of "averaging" of the curve and the assignment of a single brightness figure to each specimen, the formula $B = \left(\frac{S-D_0}{S+D}\right)^a$ is suggested. Here S is the value of the reflectance measured at 45°, D_0 the value at 0°, D the sum of the values taken every 5° from 0° through 40°, and "a" is an arbitrary constant for expanding the scale between the brightness limits of 0 and 100 set by the formula. That these limits are automatically 100 and 0 is readily shown. Thus, in the case of a perfectly bright specimen, by our above definition there will be no diffuse reflection. In other words both D and D_0 are zero and B therefore becomes $100\left(\frac{S}{S}\right)^a$ which is merely 100. On the other hand, if the specimen is perfectly dull, the light will be reflected equally in all directions, at 0° as much as at 45°. Therefore S and D_0 will be equal and therefore $B = \left(\frac{0}{S+D}\right)^a$ i.e. B = 0.

The exponent "a" is not permanently fixed, but is used as a correlation factor to a psychological function of the eye. Thus, when an observer examines a series of electrodeposits (or metal surfaces) containing some that are quite dull and some that are very bright, he subconsciously compares the very bright ones as a class with the very dull ones as being of another class. He does not distinguish appreciably between the individual samples of each, for example between the specimens in the very bright group which differ only slightly from one another in appearance. In order to pass an opinion by eye as to possible differences between such last mentioned samples, he would shut out from sight those which definitely are duller, as being disturbing to his judgment. By doing so he increases the sensitivity of his eye in evaluating small differences in brightness. The exponent "a" is used to perform a similar function. When a series of both dull and bright specimens is being considered, a value such as "a" = 8 is used, which arranges the specimens on a particular scale between the limits 0 and 100. If, however, specimens are being considered very close to each other in brightness, a value such as "a" = 50 may be employed, giving markedly greater differentiation between the surfaces in this one class of brightness. Also in this latter case are the outside limits of 0 and 100 maintained however.

On the basis of "a" = 8, the brightness figure of 100 represents pure mirror-like brightness whether it be chrome, nickel, silver, or any other metal surface, whether it be polished or produced directly by electro-deposition. It is quite obvious that where the problem is to determine the ability of a plating solution to produce a bright deposit, the basis metal must previously be polished to a brightness of 100. The first signs of decreased brightness and the first apparent signs of haze or cloud on electro-deposits of any metal coincides with a brightness figure of about 98. Somewhat duller samples are represented by figures in the neighborhood of 70 and a commercial silver plate has a brightness figure of about 25.

It is obvious, and this is one of the great advantages of the method and of the formula, that the color or "darkness" of the specimen does not affect the shape of the reflection curve and the brightness figure B. Thus, whether it be nickel, chrome, rhodium or silver, if the specimen is essentially perfectly bright, there will be no (or very little) diffuse reflection, the curve will drop sharply from a very high value to a very low (as in Specimen 1, Fig. 1), and B will equal 100. Similarly, if the specimen is only somewhat bright, there will be diffuse reflection, but only the degree to which this affects the specular will be important and not its absolute value in itself. To illustrate this by specific examples, Table I (p. 169) is included.

With the exception of the unpolished silver and the 0.016 and 0.0026 mm. cobalt-nickel, it is obvious that the amount of diffuse reflection is negligible compared with the specu-

Table I

Specimen	Reflection at 45°	40°	35°	30°	25° to 0°
Polished silver deposit	16800	0.4	negligible	negligible	negligible
Unpolished silver deposit	7800	181	30	20	14-3
Polished nickel silver	7500	0.4		negligible	negligible
Bright chrome on bright nickel	6160	0.4		"	"
Bright rhodium on bright nickel	6600	0.4		"	"
Polished cobalt-nickel deposit	12200	0.4	0.1	"	"
Unpolished cobalt-nickel deposit 0.0016 mm thick	9800	0.4	0.1	"	"
Same—0.0026 mm thick	5600	0.4	0.1	"	"
Same—0.016 mm thick	7200	1.5	0.3	"	"

lar. All these deposits would therefore have a brightness figure of 100, (when "a" = 8) as they should have from visual examination, in spite of the fact that the color and total reflectance differ from one to the other. As examples of the practical application of this fact, one might conclude that unpolished deposits of nickel-cobalt as secured above up to about 0.002 mm. in thickness could be used without causing any observable diminution in the brightness of superimposed bright chromium or rhodium and that from this particular cobalt-nickel bath, although the deposits begin to dull at about 0.002 mm., they do not dull appreciably more even up to thicknesses eight times as great, all of which agrees with visual observations.

It is evident, too, that compared to a dullness such as that of the unpolished silver deposit cited in the table, even the 0.016 mm. thick nickel-cobalt is in a brightness class by itself and close to 100. To differentiate now between this specimen, a polished one, and a theoretically perfect mirror, one would use a value of "a" equal to 50 in the formula for B, whereby

B (perfect mirror) = 100
B (polished nickel-cobalt) = 99
B (0.016 mm nickel-cobalt) = 98

This is analogous, in fact, to redrawing on a very large scale, for special study, a small part of a curve originally drawn on a small scale.

Other Applications of this Method

As has already been indicated above, the method described is not only useful for measuring the brightness of electro-deposits but indications so far are that it may also be used advantageously when measuring tarnish or other atmospheric, gaseous or liquid attack on metal surfaces. Likewise, it appears that it can be used for measuring the degree of finish or smoothness brought about by polishing compounds on metal surfaces. No doubt other applications will later suggest themselves.

Most important of all, there appears to be every reason at present for believing that the figures secured by the above method for a given surface are absolutely reproduceable anywhere, giving to the hitherto rather vague property of electroplaters' "brightness" a definite, concrete value which has as much significance as has, for example, the hardness figure for metals.

Oil Quench for Tinning

Q.—We are interested in Hot Tinning of Brass and refer to article on page 440 of your November, 1936, issue, headed "Hot Tinning of Brass."

We would appreciate your advising us what is "oil quench."

A.—The oil quench mentioned in my article, p. 440 Nov. issue of METAL INDUSTRY is the water tank with a light film of kerosene oil over the surface. The water is usually kept lukewarm in this tank. The colder it is the brighter the coating will be, but great care must be used to see that it is not too cold as this will chill the coating too quickly and make it rough. There is some place between that gives a smooth coating, and at the same time a bright glossy finish.

In some plants the oil quench is entirely kerosene oil in a circular tank surrounded by a water jacket to keep the oil cool. The articles are then plunged into this kerosene oil tank, water cooled, after draining thoroughly, on leaving the tin bath. This also gives a very bright smooth glossy coating.

The oil film can quickly be removed by drying in sawdust. A little practice will very quickly show the right conditions in either one of these methods of setting the tin coating.

—WALLACE IMHOFF.

Anodic Coating of Magnesium Alloys

Magnesium alloys have a marked susceptibility to corrosive attack under saline conditions, and protective mechanical coatings applied to their surfaces have a low degree of adherence. Previous attempts to improve these conditions by chemical treatment have led to the development of (1) the chrome-pickle treatment, which furnishes good corrosion protection and is an excellent paint base, but cannot be used on machined parts, as it materially reduces the cross section, and (2) the alkaline chromate treatment, which can be used on machined surfaces, but has been found to give inferior corrosion protection.

An anodic process recently perfected by R. W. Buzzard and J. H. Wilson and described in the January number of the Journal of Research (RP964) of the National Bureau of Standards, Washington, D. C. does not reduce the cross section materially and gives corrosion protection and paint adhesion equivalent to that afforded by the chrome pickle. The part to be anodized is first cleaned in an electrolytic bath of sodium carbonate and trisodium phosphate, and is then made the anode in a bath containing 10 per cent of sodium dichromate and from 2 to 5 per cent of monosodium phosphate. The anodic film may be applied over a wide range of current density and temperature, but the most satisfactory results have been obtained with 5 to 10 amperes per square foot at 50° C.

Salt spray tests have shown that the anodic film serves both as a corrosion inhibitor and a paint base.

The Uses of Lacquers in the Metal Industries

Products which take lacquer finishes; clear lacquers; pigmented lacquers; various novelty finishes. Lacquers reduce finishing costs.

By GUSTAVE KLINKENSTEIN

Vice President and Technical Director, Maas & Waldstein Company, Newark, N. J.

LACQUERS are used for finishing products made of every kind of material used in industry—metal, wood, leather, glass, paper, textiles, fiber, and plastics. In the metal industries, they are widely used for finishing:

Air conditioning units and equipment.
Airplanes.
Automobiles.
Automobile accessories.
Bag frames.
Bait, artificial for fishing.
Brush backs.
Buttons.
Cabinets.
Caskets.
Casket hardware.
Collapsible tubes.
Compacts.
Clocks.
Desks.
Dials, clock and instrument.
Die castings.
Electrical appliances.
Elevator equipment.
Fans, electric.
Filing cabinets.
Furniture.
Hardware.
Instruments, electrical.
Lighting fixtures.
Lipstick holders.
Name plates.
Machinery.
Piano parts.
Picture frames.
Radiator enclosures.
Radio chassis and parts.
Radio cabinets.
Razor blades.
Refrigerator cabinets.
Show cases.
Signs.
Silverware.
Steel equipment.
Switchboards.
Toilet sets.
Typewriters.
Vacuum cleaners.
Vanity cases.
Water coolers.
Washing machines.

Lacquers are finding extensive and ever increasing use in finishing metal products because (1) they protect metals from corrosion; (2) they beautify the product and make it more saleable; and (3) as compared with other types of finishes, they frequently make possible a reduction in the finishing cost per unit produced.

Clear Lacquers to Protect Metal Products

Lacquers were first used in metal product finishing to protect certain of the non-ferrous metals—principally brass, copper, silver, and bronze, in either the solid or plated forms—from "tarnishing," and this particular application is still of foremost importance.

The air contains oxygen, water vapor, carbon dioxide, and sulphur, which, either singly or in various combinations, readily attack these particular metals and quickly disfigure them. To prevent this tarnishing or "oxidation," a coating of clear lacquer is applied to the product. This coating does not add to the appearance of the metal surface, except, in some cases, to provide a somewhat deeper gloss; its purpose is to reveal and preserve the beauty of the finished metal surface. Early lacquers had little durability and soon wore off, exposing the metal to corrosion; but modern lacquers are tough and enduring and when properly selected, can protect products, such as silver candle-sticks or brass bowls, from tarnishing for many years, with intelligent care.

One of the most important of all the uses of clear lacquer is to protect brass-plated goods. The film of brass plate, as it comes from the bath, is particularly susceptible to corrosion. It is porous and moist, and any compound of sulphur in the air will instantly attack it, forming dark spots. Moreover, it is bound to contain traces of the bath chemicals, in spite of thorough washing, and these also cause spotting. To prevent this "spotting-out," the still wet plated products are coated with a special lacquer, which shields the brass film from the atmosphere and inhibits the action of the residual bath salts.

Modern developments in the clear lacquers have greatly extended their protective ability. They are now supplied for use on metals and alloys of every kind and for resisting a variety of destructive agents, such as:

Moisture.
Weak acids and alkalies.
Household chemicals.
Fruit juices.
Alcohol.
Grease and oils.
Brine.
Human perspiration.
Human saliva (for toys).
Rust and Electrolysis (for iron and steel).
Abrasion.
Temperatures up to 300 degrees F. and higher.
Match flames and glowing cigarettes.

Clear lacquers are also used to protect less durable finishes applied to metal surfaces, such as soft undercoats, graining, lithographing work, bronzing, etc. Such "top-coat" lacquers protect the underlying finish and also usually impart a high gloss.

Pigmented Lacquers

Lacquers when colored are properly called "lacquer-enamels," and are to be distinguished from enamels, which are technically colored varnishes.

By the use of transparent or opaque pigments, lacquer-enamels can be supplied in any known color. To illustrate the possibilities in this direction, a single line of lacquer-enamels has been made up in over 400 differing shades. This wide color range in these easily applied, durable finishes has made possible the modern "color movement," which has notably increased the market not only for all kinds of products for personal and household use but also for technical equipment. The proper selection of the color of even so humble a product

as a can-opener has become a factor of major importance in product design because of the influence that color has on saleability.

The gloss produced by a lacquer-enamel on drying can be varied at will by the lacquer chemist, from high, medium, or low, to a glossless egg-shell or mat surface. For certain high-grade products, a superior finish is produced by using a type of lacquer that dries with a surface which is naturally rather dull but which can be brought to a brilliant gloss by rubbing and polishing.

Lacquer-enamels are by no means confined to simple colors. A large variety of special color and surface effects have been developed, of which only a few can be mentioned.

Metallic Finishes—Clear lacquer forms the vehicle for the application of "bronze" powders, by which is meant powdered metals of any kind, whether simulating silver, gold, copper, brass, bronze, aluminum, cadmium or oxidized copper. The finished surface may reproduce the metal in either the mat or polished form.

A finish that is especialiy popular today for many different products is a pigmented lacquer-enamel carrying a certain amount of bronze powder. This type of finish is lustrous and full of metallic high lights.

A recently developed line of transparently-colored lacquer-enamels reproduces the brilliant colors produced by the anodic and other chemical processes.

Crystallizing Finishes—A special type of finish crystallizes as it dries. These crystals grow until they cover the entire surface finished. When clear finishes of this type are applied to polished metal surfaces they give the appearance of crystals of the metal.

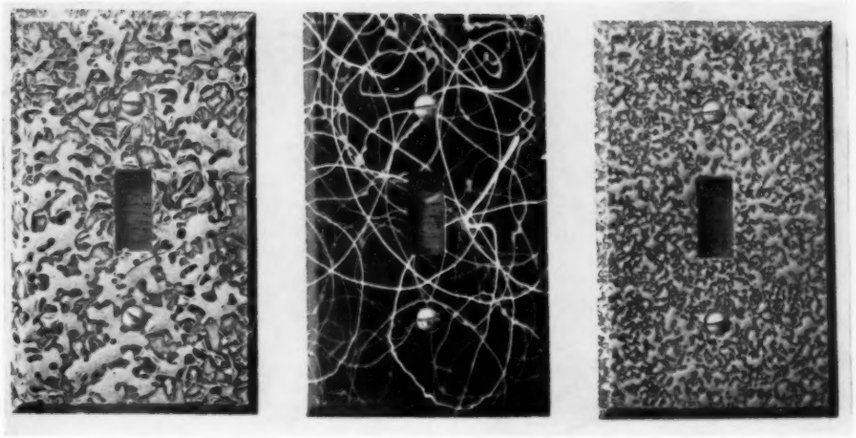


Fig. 1A *Fig. 1B* *Fig. 1C*

Fig. 1A—A stipple finish, applied to form large figures, and sprayed with silver and smutted with black Japan color. Fig. 1B—Marbleizing lacquer in three colors sprayed on a base coat of black enamel. Fig. 1C—A stipple finish, applied to form small figures, and sprayed with silver and smutted with green Japan color

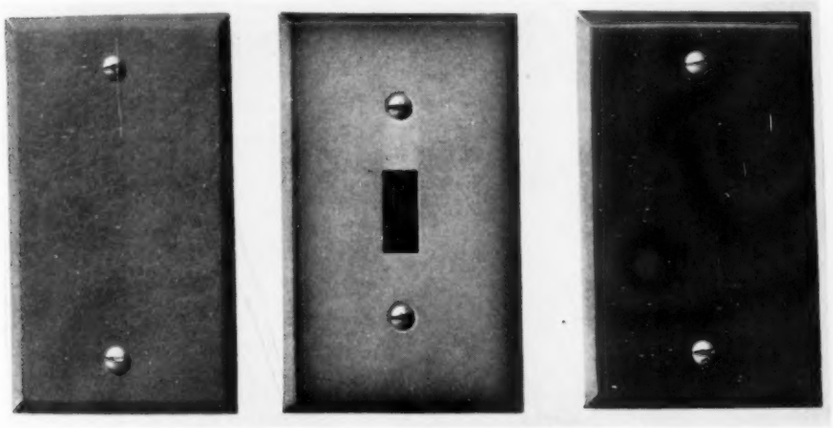


Fig. 2A *Fig. 2B* *Fig. 2C*

Fig. 2A—A crackle finish covered with tan enamel. Fig. 2B—Silver Metalustre shaded with a black shading stain. Fig. 2C—Bronze Metalustre to which pearl essence has been added

Checking Finishes—The cracked and checked finishes of antique furniture and china can be reproduced by the use of lacquers which crack open on drying. By using different combinations of ground and checking lacquer colors, a wide variety of effects can be procured.

Crackle Finishes—Crackle finishes are produced by the use of a lacquer which forms irregular spots on drying, leaving portions of the undercoat exposed after the manner of checking lacquers but forming quite different designs.

Float Finishes—By floating special floating lacquers on water and bringing the article to be finished up through the water so that the colors adhere to it, a wide variety of effects,

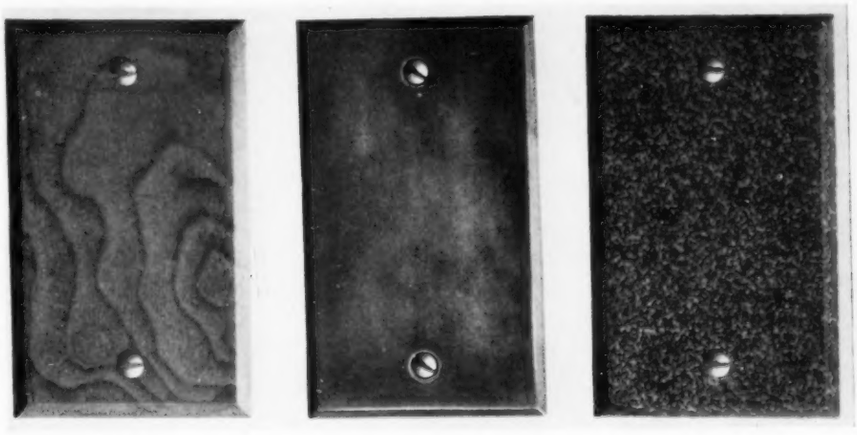


Fig. 3A *Fig. 3B* *Fig. 3C*

Fig. 3A—Black with green stipple. Fig. 3B—Bronze Metalustre shaded with verde green pigment. Rubbed with wax and pumice. Fig. 3C—A walnut undercoat with grain applied with graining paper. A top coat of lacquer is then applied and rubbed and polished

Fig. 4A *Fig. 4B* *Fig. 4C*

Fig. 4A—Brass plate covered with a coat of clear crystallizing Prismlac. Fig. 4B—Black crystallizing Prismlac smutted with gold bronze powder in clear Japan and turpentine. Fig. 4C—Clear crystallizing Prismlac smutted with black Japan color

in as many different colors as may be desired, can be obtained.

Mottle Pearl Finishes—The finish of mottle pearl celluloid toilet goods can be copied on metal by covering the surface with a coat of lacquer-enamel and following this with a coat of special pearl paste. Before the latter coat is dry, it is rolled with twisted chamois or a sponge mounted on a roller, giving the mottled effect.

Stipple Finishes—Stipple lacquers dry with very rough surfaces, forming irregular designs which can be varied in shape and size at the will of the finisher. By covering the stipple surface with lacquer-enamel of one color and "smutting" the depressions with black, dark green, etc., many attractive effects can be produced.

Marbleizing Finishes—Marbleizing or veiling lacquers string out in fine threads or cobwebs when they are applied. Various colors can be applied on a colored background.

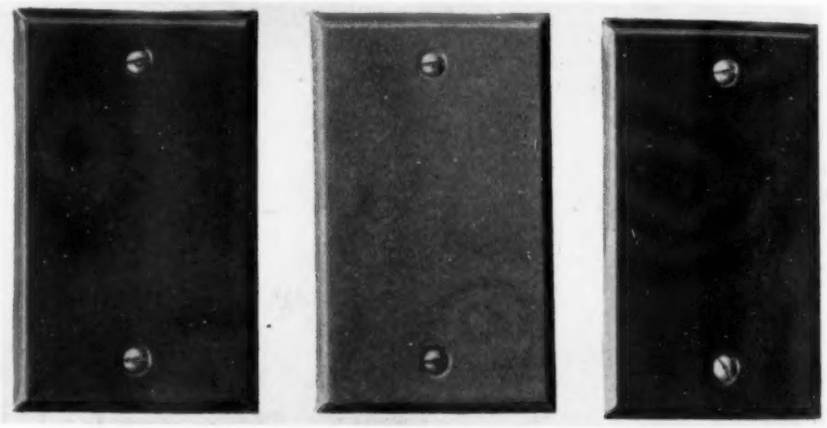


Fig. 5A *Fig. 5B* *Fig. 5C*

Plates finished in brilliantly colored lacquer. Fig. 5A—green. Fig. 5B—red. Fig. 5C—blue

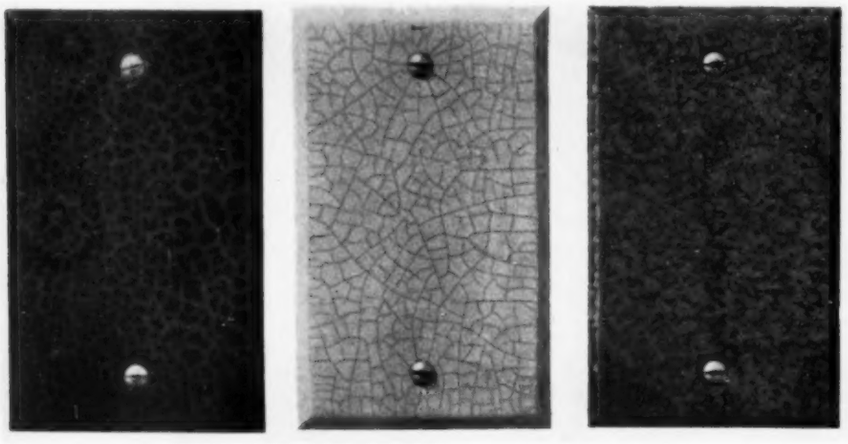


Fig. 6A *Fig. 6B* *Fig. 6C*

Fig. 6A—Black crackle finish on green enamel. Fig. 6B—Finished with Checklac, a checking finish, and smutted with raw umber Japan color to bring out the cracks. Fig. 6C—A stipple finish covered with bronze Metalustre and smutted with verde green pigment

Reducing Finishing Costs with Lacquers

Lacquers may cost more per gallon than other types of industrial finishes, —varnishes, enamels, Japans, paints, etc.—but because of their special properties and the ease with which these properties can be altered by the lacquer chemist to suit any given set of manufacturing and service conditions, their use often reduces the cost of finishing a given product.

Other types of finishes, as a rule, air-dry slowly, remaining tacky for from several hours to a day, or else they have to be baked. Lacquers, on the other hand, air-dry rapidly and completely, and are ordinarily firm enough to be handled in a few minutes. When, therefore, lacquers can be substituted for the slower drying finishes, production is speeded up, and large drying rooms or baking ovens are rendered unnecessary.

Lacquers have not, however, eliminated baking from industrial finishing. Finishes with certain qualities, such as great durability under severe service conditions, can be obtained only by using materials that require baking. But even under such circumstances the use of lacquers can often simplify the finishing process.

For example, in finishing metal furniture with a wood grain, it has been common practice to apply first a coat of primer, which is baked; then the graining which is also baked; and finally the top coats. A lacquer has been developed which can be grained on air-drying, after which both coats are baked together, thus saving one baking operation.

Another example of the way in which lacquers can reduce finishing costs is furnished by zinc and aluminum die castings. These particular metals have, in the past, proved very difficult to finish because they react chemically with most finishing materials, and coatings applied on them often peel off. Hence it has been necessary to subject die castings to a chemical treatment that alters their surface characteristics before finishing them. Lacquers have, however, been recently developed which adhere firmly to zinc and aluminum, so that die castings can now be finished in any desired color and gloss just as they come from the molds, provided the surfaces are clean and free from scale.

The problem presented by the finishing of fixed condensers for radios is typical of a number of cases. A fixed condenser when ready for finishing consists of nothing but a metal case within which the electrical elements are sealed, and it is, apparently, the simplest kind of a product to finish. But the case is filled with a waxy insulating material, and unless this wax is completely removed from the case, it cannot be successfully coated with many of the ordinary finishes. But a special type of lacquer can absorb traces of this wax without loss of adherence, thus substantially reducing the cost of the cleaning operation.

Again, production costs can often be reduced by using raw materials or parts finished in advance with lacquers developed to withstand without injuring machining, stamping, drawing, forming, and other manufacturing operations. It is obviously cheaper to make metal bottle caps out of prelacquered stock than to lacquer the tops individually after they have been formed. Striking effects can be obtained by lacquering compact cases and other items before engraving or engine-turning them. Name-plates can be finished in large sheets and the separate plates sheared off and formed afterwards.

Similar examples could be multiplied indefinitely, since hardly a day passes without some manufacturer learning of ways to simplify his manufacturing process by the use of lacquers designed to meet his special requirements.

The possibilities that lie in cost reduction through the use of specially developed finishes have brought the maker of industrial finishes into the engineering field. His chief business is no longer to supply standard finishes on order, but to recommend a comprehensive finishing schedule after he has gone into the product manufacturer's plant and studied the product itself, the process by which it is produced, the service conditions to which it is to be subjected, and the influence that color will have on its sales.

Product manufacturers, on their part, are well advised if they look for this kind of service from their supplier of finishes.

It is not wise to treat the product's finish as a mere superficial detail to be selected and applied by those without expert knowledge of the subject.

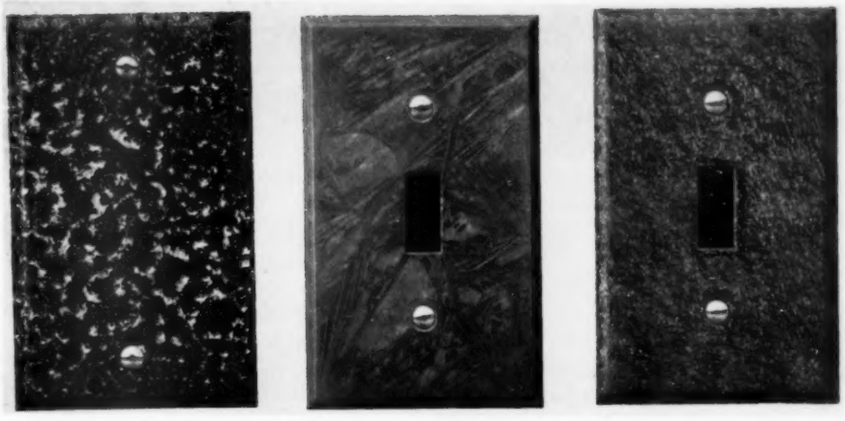


Fig. 7A *Fig. 7B* *Fig. 7C*

Fig. 7A—A stipple finish covered with black baking enamel, after which a coat of aluminum lacquer is applied. Fig. 7B—Brown crystallizing Prismlac. Fig. 7C—A wrinkle finish sprayed in one direction with red bronze lacquer and in another direction with blue bronze lacquer

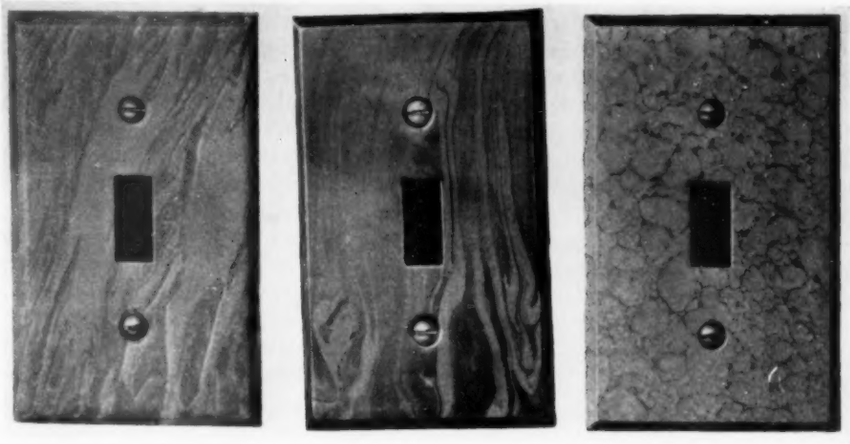


Fig. 8A *Fig. 8B* *Fig. 8C*

Fig. 8A—Green enamel covered with pearl paste, which is rolled with twisted chamois before drying, giving mottled finish. Fig. 8B—Finished with floating enamels in several colors. Fig. 8C—Silver Metalustre covered with a spatter coat of green paste and gold bronze powder

Oxidizing to Prevent Spotting Out

Spotting out can be minimized by rinsing well after oxidizing. Rinse the article alternately in hot and cold rinses several times. This sets up expansion and contraction which will assist in removing salts from the porosity of the metal.

Also, do not allow castings after finishing to stand around where they will collect particles of sulphur from scratch brushing or other dusty operations.

Also, use a non-spotting out lacquer. These are obtainable from lacquer manufacturers advertising in the METAL INDUSTRY. This will assist as much as any other single corrective.

—G. B. H.

The pH of Alkaline Electro-Plating Solutions

The importance of checking alkaline solutions for pH, as well as acid solutions.

By Dr. RICHARD SPRINGER

Laboratory of the Langbein-Pfanhauser-Werke, A. G., Leipsig, Germany

FOR a number of years it has been common practice to test the pH value of nickel solutions by various methods. On this subject an article appeared in the magazine in the December, 1936, issue of this Journal. While the importance of checking nickel solutions by the pH method is well known, comparatively little has been published regarding the pH determination in electrolytic alkaline solutions. It is, however, of no less importance.

The pH number is frequently called the "acidity number." But the pH number can be used just as well regarding alkaline solutions. It is a well-known fact that the acid reaction is caused by hydrogen ions (H+) and the alkaline reaction by hydroxyl ions (OH—). In chemically pure water hydrogen ions and hydroxyl ions are balanced and the water is neutral. The two kinds of ions are present, however, although in very small concentration. This concentration corresponds to a pH value of 7.0 in other words 7.0 *is the point of absolute neutrality*. If acid is added the number of hydrogen ions will increase and the pH value fall below 7.0, as was explained in the last article about pH value in acid solutions.

If, however, an alkali, such as caustic soda (NaOH) is added to chemically pure water, then the concentration of the hydrogen ions is reduced below the normal value of the water and the pH value of the solution increases. The more alkaline a solution, the higher its pH value. The pH value is therefore a means of showing the alkalinity of a solution. Its determination is of considerable value to the practical plater.

In the practical plating shop the following seven alkaline solutions are mainly used:

(1) Brass baths; (2) Copper baths; (3) Cadmium baths; (4) Silver baths; (5) Zinc baths; (6) Tin baths; (7) Alkaline cleaners.

1. BRASS. Of all alkaline solutions, a brass solution is perhaps the most difficult to keep under control. No doubt, many practical platers have had the experience that a solution would not work satisfactorily although the contents of metal conducting salts and cyanide were correct. In such cases no other remedy is generally known than to dilute the solution and regenerate it by the addition of salts. There are cases, however, where the desired results cannot be obtained and the electrolyte will have to be prepared anew.

In a series of experiments it was tried to determine the pH value of such unsatisfactory brass solutions. The significant fact was established that in almost all cases the pH number was above 10.3 (composition of the bath being correct). To investigate further, the pH range from 9.9-13.5 was checked systematically; i.e. to a freshly prepared and satisfactorily working solution with a pH value of 9.8 were gradually added alkaline salts and deposits were made at various pH values. Results were as follows:

1. Between 9.8-10.2 the brass solution worked well.

2. At 10.3 the first signs of spottiness were observed. Spots became more numerous with increasing pH number. At pH 11.0 the deposit had the dirty appearance of olive-green.

3. Further heightening of the pH number resulted in better appearance of the deposits and at 12.5 pH the deposit had an even shade similar in color to that of red brass. This shade remained constant up to 13.5.

Experiments were made with salts from various sources. Most of them showed the same regular changes. Only in the case of solutions prepared with chemically pure salts the deposit changed at 10.3 to an even shade similar to bronze. But when worked for a prolonged time with purest brass anodes, even these solutions gave the same results. It is assumed that very small particles of foreign metal in the brass account for this fact.

The practical conclusion would be that in brass solutions the pH number should be kept within the range of 9.8 to 10.2 as otherwise there is a tendency for the deposits to turn out spotty.

It is interesting to note that with ordinary brass solutions deposits similar to bronze can be produced if the pH value of the electrolyte is raised to above 12.0. However, if such a solution is used continuously for obtaining bronze-like deposits, then rich low brass anodes must be employed. Otherwise the normal ratio between copper and zinc would unduly change.

2. CADMIUM SOLUTIONS. Every practical plater working with cadmium solutions will have noticed occasionally that deposits turned out blistered or peeled off the base metal. Formerly this was ascribed to an excessive content of free alkali in the solution. Therefore alkali was neutralized by addition of acid salts or acid. However, experience has shown that such addition do not always give the desired results. In such cases only diluting the electrolyte and adding new salts was successful. To check up on this matter, tests and pH determinations in a number of cadmium solutions working under practical conditions showed that adherence was better with higher pH values of the respective solutions. Systematic laboratory experiments showed that cadmimum deposits were best within a pH range of 12.0 to 13.0. Under 11.5 the

cadmium peeled off when the sheet was bent vigorously. Above 13.0 pH the adherence became slightly less satisfactory. These observations will make it easier in future to obtain deposits of good adherence from cadmium solutions, (provided, of course, that the cleaning and composition of solution are correct). It has been observed in some cases that decomposed brightening agents caused the peeling off, but such cases are rare.

3. Copper Solutions. With cyanide copper solutions pH value is not quite so important, but it has been observed that copper solutions having a high content of cyanide of sodium gave blistered deposits at current densities of 0.1-0.3 amp. per square decimeter if the pH value was below 10.7. According to experiments made, a pH value of 10.7-11.0 can be regarded as the optimum for copper solutions. Although above 12.5 pH very finely grained deposits (of a darker color) can be obtained, the pH value should not be raised above 11.0 unless the tank is provided with a suction device. Practice has shown that above 12.0 pH alkali fumes develop which inconvenience the operator.

4. Silver Solutions. It was not possible to determine the influence of pH value on the working of the solution. This is an important field for the practical man to clear up. Every plater can gain valuable experience by carrying out systematic tests.

5. Zinc Baths. Alkaline zinc solutions work at their best above pH 13.5.

6. Tin Solutions. Hot alkaline tin solutions should preferably have a pH value of 13-13.5 measured at room temperature.

7. Alkaline Cleaners. These solutions do not come within the range of measurement with indicators. The highest pH value measurable by means of the pH paper is 13.5. However, pH paper can be used to good advantage in checking up on alkaline cleaners owing to the fact that if these solutions have a pH value under 13.5 (which happens quite often in practice) they have been considerably worked down and should receive an addition of new salts.

Reclaiming Gold from Gold-Filled Articles

Q.—I would like to have information covering the process of reclaiming the gold (as a fulminate or a powder) from white and yellow gold-filled articles. While I have not enough of this metal to pay a refiner's charge, as I have the necessary acids I would like to do this myself.

A.—Reclaiming the gold from gold filled or rolled gold articles is not easily accomplished at a profit. In the first place, the quantity of gold is not large, rarely as much as 5%, usually much less, especially in articles that have been exposed to wear. In the second place, these articles generally contain soft solder, and it complicates the process of refining. The task of removing it by acid methods is not simple, and if by chance you fail to remove it entirely, the gold you recover will be of poor quality. The professional refiners do not seek this kind of scrap, because the process of reclamation, even when carried on a large scale, is not a highly profitable one.

When carried on a small scale, it is even less profitable.

One method is to break up the scrap and immerse it in nitric acid, which eats out the base metal core, leaving thin shells or flakes of gold alloy. These shells, if melted up, will yield a button that may run from 10-k to 14-k, more or less. Inasmuch as nitric acid does not wholly dissolve some kinds of solder, but leaves a residue that clings to the gold shells, this button may be of extremely poor quality. In no case will it be fine gold; in other words you will have to carry out a further purification if fine gold is required.

Another plan is to dip the scrap in aqua regia, which dissolves the outer gold layer; it also works on the base metal core, sometimes with even greater speed than on the gold. It is difficult to know when to stop the action, and in all cases considerable base metal is dissolved. The resulting solution will first be evaporated down to a syrup to get rid of the excess nitric acid, then diluted and filtered to remove silver chloride and other impurities; then the dissolved gold may be precipitated out, probably by means of copperas. In some cases this yields a powder of rather high quality. But if your original scrap contained much soft solder, this gold powder is again apt to be contaminated, and when melted will yield a brittle or off-color button, fit only for further refining.

A third method is to use a cyanide bath and a "reversed" electric current; the outer shell of gold will be dissolved off, but more or less base metal will come with it, and again it is hard to know when to stop. The cyanide solution will then contain not only gold, but also nickel, silver, copper, and other base metals. The dissolved gold is usually recovered as a powder by means of zinc.

The refiner who handles this scrap in large lots rarely uses any of the above methods. Sometimes he melts such scrap in with other stuff of much lower grade, such as floor sweeps; sometimes it is sold to a copper refinery, where it is melted in with impure copper and refined by electrolytic methods in which tons of metal are handled daily; the gold and silver are recovered as by-products.

Every handler of gold is advised to familiarize himself with the Government regulations and obtain the proper license for his purpose. These licenses cost nothing. Application blanks may be obtained from the Assay Affice or Mint of your district or from your Federal Reserve Bank. —Jewelry Metallurgist.

Polishing Sand Cast Aluminum*

The outside surface of sand cast aluminum articles is generally rough polished on a dry set-up wheel with No. 60 or No. 80 Alundum grain, followed by No. 120 or No. 150. The composition of the metal sometimes calls for finishing with finer sizes. Grease is used on all wheels after the roughing operation.

"Sizing" the Wheel*

A common method is to "size" the wheel and hang it up to dry. It is then placed on the lathe at running speed and the face rubbed lightly with a fine abrasive brick. This will raise the nap slightly and the coat of abrasive and glue will stick better.

* From Facts About Metal Polishing, Norton Co.

Shop Problems CASTING • METALLURGICAL FABRICATION • ASSEMBLING • • PLATING • FINISHING

Questions from readers relating to shop practice and answers by our associate editors

Contaminated Nickel

Q.—We are mailing to you a sample of still plating nickel solution. This solution has been in use for quite some time and has produced excellent deposits. Trouble has developed while plating small intricately shaped machine parts. The edges of the pieces turned black and the deposit toward the center became brittle and scaled off. Operating temperature of the bath is 80° F and the steel parts are copper plated before being nickel plated.

A.—Analysis of solution is:

Nickel	2.34 ozs./gal.
Chloride, as ammonium chloride	2.81 ozs./gal.
pH	6.1

The nickel and chloride can be brought up to 3 ozs./gal. They are in fair condition, now, however. The pH should be corrected to 5.8 by adding sulphuric acid. It is also suggested you add boric acid.

The black edges are evidently due to copper or zinc impurity in the solution in small amount. This can be worked out by making the solution acid (pH of 5.2 or lower) with sulphuric acid. Then electrolyze the solution for 5 or 6 hours. This will plate out copper and zinc, then bring back pH with ammonia.

Copper alone can most easily be removed by hanging in pieces of scrap iron, no current, which will remove copper by immersion. This is best done when the solution has been made acid as described above.

After above treatments the boric acid can be placed in the solution. You can add up to 2 ozs./gal.

—G. B. H., Jr., Problem 5,569.

Electrolytic Finish for Steel

Q.—We have heard that there is an electrolytic type of finishing for sheet steel, and if so, we would like information.

A.—Evidently you are not referring here to an electrodeposited finish, but it is not clear just what finish is meant.

There is a process known as "electrogranodizing" which is not a finish in the true sense of the term, but which is a method of pretreating steel so as to form a surface that is a good base for subsequent lacquer or enamel coatings.

If you could supply just the connection or application of the electrolytic finish to which you refer more definite information could be given.

For details on the above mentioned process get in touch with the American Chemical Paint Co., Ambler, Pa.

—G. B. H., Jr., Problem 5,570.

Increasing Acidity and Agitation

Q.—Can you give me any information on the following:

1. The effect of agitation and in-

Use this Blank for Solution Analysis Information

Fill in all items if possible.

Date .....

Name ..... Class of work being plated: .....
Address ..... Volume used: .....
Employed by: ..... Solution depth: .....
Kind of solution: ..... Cathode surface, sq. ft.: .....
Tank length: ..... width: ..... Kind of anodes: .....
Anode surface, sq. ft.: ..... Distance from cathode ..... Original formula of solution: .....

REMARKS: Describe trouble completely. Give cleaning methods employed. Send small sample of work showing defect if possible. Use separate sheet if necessary. _____

NOTE: Before taking sample of solution, bring it to proper operating level with water; stir thoroughly; take sample in 2 or 3 oz. clean bottle; label bottle with name of solution and name of sender. PACK IT PROPERLY and mail to METAL INDUSTRY, 116 John Street, New York City.

creasing acid (H_2SO_4) on the copper anodes used in the acid copper bath, using high current density.

2. The effect of increasing acidity and agitation on the anodes in the usual nickel plating solution using high current density.

A.—The increase of agitation, or of acidity will in themselves have no serious effects on anode corrosion. If anything, the anode corrosion should be improved.

However, if the increase in agitation and acid content is accompanied by a rise in the current flowing through the same anodes, that is, an increase in anode current density results, difficulty may be encountered with the obtaining of a granular and coarse type of anode corrosion. This will cause metallic particles to be liberated in the solution and result in rough work.

Air agitation is not advisable in the usual nickel solution, although it is employed in electrotyping nickel solutions.

—G. B. H., Jr., Problem 5,571.

Metal on Babies' Shoes

Q.—We have found the demand for metallized baby shoes increasing and although we have done this type of work for some time, the process we have been using has not been entirely satisfactory. It does not seem to make the shoes heavy and hard enough and they have a tendency to peel after a time.

Also we would like to learn of a metallizing powder that can be used before plating the shoes that will adhere to the shoe better than that which we are using.

A.—A method for finishing baby shoes is contained in the 1931 edition of the Platers Guidebook.

The metallizing powder to use must be free from oil and grease. See the advertising pages of METAL INDUSTRY.

—G. B. H., Jr., Problem 5,572.

Nickel Solution

Q.—We are making a new solution for a larger tank and would like advice on the solution formula to use. Most of our work is chrome finish. I have wondered if a bright nickel would be practical. We would not consider a hot bath at this time but would like to have as much volume as possible with a moderate sized tank. We have plenty of generator capacity for this tank and so wish to use as high a current density as possible.

A.—A good nickel solution for regular class of work is made from:

Single nickel salts	14 ozs.
Double nickel salts	2 ozs.
Ammonium chloride	3 ozs.
Boric acid	3 ozs.
pH	5.8

It will be noted that this formula differs slightly from the one given on page 18 of the Platers Guidebook. This is advisable in your case as the lower double salt content as given above will give less trouble from crystallizing out.

As regards bright nickel you have the choice of the old style gum brightener solution or one of the more modern hot, high speed, bright nickels. The former type is not reliable for chrome work as the deposit is liable to be brittle and flake off. Also, the brightness is often not good enough to allow chrome plating direct on it.

For details on the new type bright nickel solutions it is suggested you write some of the advertisers in the METAL INDUSTRY which handle this kind of solution.

—G. H. B., Jr., Problem 5,573.

Ornamental Bronze

Q.—I would greatly appreciate any detailed information you may furnish me on a formula for oxidizing ornamental bronze to (1) permanent verde green and (2) permanent brown finish for outdoor work. Will moisture from the ground affect, or make the finish "peel" from the bronze when it is set into the ground, such as a bronze memorial marker? I would also appreciate the formula for oxidizing bronze by the sawdust method.

Is a coat of wax or oil necessary after oxidizing? If so what formula do you recommend without darkening the verde-green finish.

A.—In answer to the question as to a permanent verde finish for outdoor exposure it can only be said that these finishes produce a coating on the metal that is dependent on the chemicals used. When the metal is exposed to outdoor conditions and to chemical action that is different from the basic chemical action which produced the antique finish, then that finish will be changed in some way.

In other words, since bronze is susceptible to chemical attack even through the artificial finish, it will be effected if the article is placed in the ground. The finish will not peel, however, but be changed in color. The extent of the change in color will depend on the soil conditions. This can only be determined by trial over a period of time. The pH, temperature, moisture etc. of the ground will all be factors influencing the finish.

The sawdust method: A verde finish can be had from:

Sodium chloride	4 ozs.
Copper acetate	¼ oz.
Acetic acid	2 ozs.
Zinc chloride	¼ oz.
Copper sulphate	8 ozs.
Water	1 gal.

Stipple the work with the above solution using a short bristle brush. Then bury in sawdust that has been wet and allowed to stand a week with:

Acetic acid	6 ozs.
Sodium chloride	4 ozs.
Water	1 gal.

Bury for 24 hours. Then remove and wax, using a 50-50 mixture of carnauba wax and beeswax dissolved in turpentine.

The wax is only a more or less temporary protection. No wax coating will be permanent. Cleaning and rewaxing at occasional intervals is the best method of preserving the finish.

—G. B. H., Jr., Problem 5,574.

Plating Jewelry

Q.—One type of plating that has been giving us some trouble is that on cheap novelty jewelry that has been soldered, set, etc. This includes the rhinestone jewelry with a bright white finish and yellow plated jewelry. Because this is cheap jewelry we do not get a very good price for repairing it and therefore cannot afford to use gold and silver plating on it. Any information you can give us on a cheap rhodium plating that will give a shiny finish and any kind of gold color paint or plating process that will satisfactorily color yellow novelty jewelry will be appreciated.

There are several cheap white finishes on the market. See the advertising pages of METAL INDUSTRY.

A.—A cheap gold finish can be made by the gold dye method. This involves the use of a lacquer which is allowed to dry on the work. This is then dipped into a solution of dye which colors the lacquer film. Any reputable lacquer manufacturer will supply this type of lacquer and dye.

—G. B. H., Jr., Problem 5,575.

Metal Casting Digest

Short abstracts of articles of interest to practical non-ferrous foundrymen and metallurgists

By H. M. ST. JOHN
Associate Editor

THE BLOODY "BATTLE OF THE METALS." S. K. Colby. Iron Age, Vol. 138 (Oct. 1st, 1936), page 38.

Metals are not truly competitive. Each has its place and plenty of opportunity.

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A REVIEW OF COPPER ALLOYS. Part I. M. G. Corson. Iron Age, Vol. 138 (Oct. 15th, 1936), page 114.

The author discusses copper alloys from the standpoint of their maximum qualities and concludes that little further improvement is possible by alloying alone. Where low cost, coupled with fair mechanical properties and resistance to corrosion, is the principal consideration, zinc is the most important alloying element. For castings of better quality other elements, such as tin and nickel, are added in various proportions to make up the familiar foundry alloys of red brass and bronze. Lead is primarily a dilutant. For maximum resistance to corrosion the newer silicon bronzes (2.5 to 4.5% silicon with small percentages of manganese, tin, zinc and iron) have taken top place. The precipitation hardening of copper alloys is discussed in detail.

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A REVIEW OF COPPER ALLOYS. Part II. M. G. Corson. Iron Age, Vol. 138 (Oct. 22d, 1936), page 29.

The author classifies copper alloys according to their properties and applications. This installment deals with alloys containing small percentages of tin, cadmium, chromium or nickel and silicon, alloys having strengths much above that of pure copper without a correspondingly great loss in conductivity. Castings containing 0.5% chromium can be made with a tensile strength of 50,000 lbs. per sq. in. (as compared with 30,000 lbs. for pure copper) and an electrical conductivity of 85%, a loss of only 15%, with a gain of 70% in strength and 200% in hardness. When great strength with moderate ductility is the most important consideration, copper can be alloyed with about 7% nickel and 5 to 8% tin to produce castings which, when heat treated, have a hardness of 220 Brinell, a tensile strength of 110,000 lbs., an elastic limit of 70,000 lbs., with an elongation of 5%.

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DETAILS OF X-RAY APPARATUS. Robert C. Woods. Iron Age, Vol. 138 (Oct. 22d, 1936), page 36.

A description of the equipment needed and the principles governing its operation, given as a guide to foundrymen who may be considering the purchase and use of such apparatus.

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AGING PHENOMENA IN A SILVER-RICH COPPER ALLOY. Morris Cohen. Metals Technology (Oct., 1936). A paper delivered at the Cleveland meeting of the Institute of Metals Division, A. I. M. E.

An experimental investigation of precipitation hardening in an alloy containing approximately 8.8% copper, 91.2% silver.

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THE HEAVIER NON-FERROUS METALS IN TRANSPORTATION. C. H. Mathewson. Metals Technology (Oct., 1936). A review.

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LIGHT-WEIGHT METALS IN THE TRANSPORTATION INDUSTRY. Zay Jeffries. Metals Technology (Oct., 1936).

A review.

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X-RAYS AMONG THE METALS. Ancel St. John. Metal Progress, Vol. 30 (Oct., 1936), page 162.

In a general discussion of X-ray applications the author cities the favorable experience of a foundry which uses the X-ray on the first castings from a new pattern to determine whether changes should be made in the design. In regular production no attempt is made to examine every casting; samples from each lot are examined and if defectives are found the whole lot is set aside for careful inspection.

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PYROMETRY, THERMOELECTRIC, OPTICAL AND RADIATION. Metal Progress (Oct., 1936), page 167.

Extracts from articles by Kirtland Marsh and by P. H. Dike which will appear in the new edition of the ASM Metals Handbook. The various types of temperature-measuring equipment available to the foundryman are discussed.

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COPPER CASTINGS ALLOYED WITH BE AND TI. G. F. Comstock. Metals and Alloys, Vol. 7, page 257 (Oct., 1936).

Experimental work is described covering hardness tests and electrical conductivity measurements on copper-alloy castings containing up to 2.7% beryllium and up to 1.2% titanium, as cast and after various heat treatments. The effect of titanium without beryllium is influenced largely by the percentage of silicon which accompanies it. With comparatively high silicon (0.23 to 0.40 per cent), after a suitable heat treatment, a Rockwell hardness of 85E and an electrical conductivity of 42 to 45% were obtained. When used in conjunction with beryllium the principal advantage of the titanium seemed to be that it retarded the softening of the alloy when heated to temperatures above its optimum hardening temperature. Although the addition of titanium to beryllium copper decreased the electrical conductivity of the latter, this difference soon became negligible when the alloy was heated to a temperature of 900 to 1000° F.

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CERTAIN AGE-HARDENABLE COPPER ALLOYS. L. R. Van Wert and B. W. Gonser. Metals & Alloys, Vol. 7, page 269 (Oct., 1936).

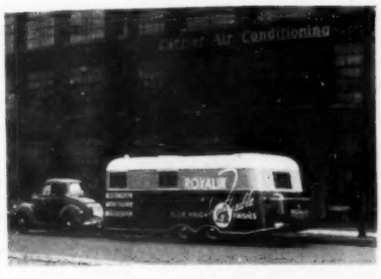
Discusses the X-ray examination of certain copper-nickel-silicon alloys with relation to hardness and electrical conductivity after heat treatment.

Modern Production Equipment

New processes, machinery and supplies for metal products manufacturing and metal finishing

The Roxalin Trail Blazer—A Traveling Display

On Monday, March 8th, a group of business paper editors attended a meeting at the plant of the Roxalin Flexible Lacquer Company in Elizabeth, N. J., where they were treated to a tour of the plant and laboratories and a preview of the Trail Blazer the last word in graphic and mobile



The Roxalin "Trail Blazer"

demonstration of what lacquer and synthetic finishes can do to protect and beautify manufactured products.

The Trail Blazer itself is a trailer, 22 feet long, elegantly equipped and finished in two shades of blue and aluminum. The Roxalin flexible finishes used were applied at the plant. Several people can be comfortably seated to talk business over a table and there is ample room for visitors to circulate freely viewing the exhibits which are placed in wall panels and show cases. The displays presented more than 200 parts and assembled products actually in commercial production, which have been finished with Roxalin flexible lacquer and synthetic finishes, in every conceivable style, design, color and shade, to stand every type of use and abuse, chemical and physical.

The basic materials upon which finishes were shown included metals, wood, rubber, textiles, leather and paper. The finishing problems were infinitely varied. resistance to human perspiration; resistance to weathering; resistance to chemicals—acids and alkalies; resistance to abrasion, blanking and forming. And in every case these qualities that preserve long finish life are the foundation for the all-important—Beauty—Style—Fashions in Finishing.

Every exhibit in the Trail Blazer had a story to tell. The "Port Hole" test showed a piece of metal foil, clear-coated with Roxyn C (an air drying or baking synthetic), spotted by nitric acid on the uncoated side. The acid had eaten through the metal to the transparent film and had stopped right there. Steel tubes finished with one coat of Roxyn C withstood hard banging together without chipping, flaking or peeling. On discs finished with Blue Knight flexible finishes, the various stages of blanking and forming, after lacquering were shown. An exhibit of name plates, dials, etc. demonstrated the production advantages of finishing materials so highly flexible and adherent.

Another interesting exhibit of the properties of the same material was the Brittling Test conducted by an electrical manufacturer. An aluminum fan blade, coated with this finish, was subjected to 212° F. in a steam oven for *two years* with no loss of flexibility or adhesion.

One of the most striking exhibits consisted of finished rolls of metal edging for boxes. The edging was made of strip steel, first coated with Blue Knight flexible finishes in all colors; then slit and perforated; then reeled. These reels are sent out to shipping rooms all over the United States where paper box flats, lithographed and printed, are assembled on automatic machines, which form the angle and sink the projections into the cardboard. All of these operations are applied without chipping, flaking or peeling of the flexible finish.

Interior of trailer; front end

Samples of work illustrated the application of Ba-Flex before the plating operation as it withstands all plating solutions including chromium, and is buffable without "drag."

Fashions in Finishing

Rincon-trol, a texture synthetic, was portrayed as an easily controlled wrinkle finish without "fatty" edges, with fine grained texture (small craters) and resistant to perspiration. The Carrier Corporation uses this finish on its air conditioning units as large as 3′ 6″ by 5′ 6″ by 3′ 3″, achieving extraordinary uniformity and fineness of texture. A new style note in texture finishes is the combination Roxyn-Rincon-trol, two-coat, one-bake system put on as follows:

1. Application of Roxyn-C which air dries in lacquer time.
2. Rincon-trol follows immediately.
3. One bake for one hour at 275° F.

This combination was shown on zinc and aluminum die castings to demonstrate the new fashions in finishing, resulting from interesting stencil applications and two-tone work done with only one bake.

An extraordinary feature of Roxalin's operations, explained by Leo Roon, president, during the discussion at luncheon, is the fact that the company employs more men in the laboratories ("The Heart of Our Business") than in the plant—*and that it pays.*

The Trail Blazer will present its story visually and graphically to manufacturers throughout the United States, demonstrating how many applications lacquers have; how lacquers can brighten merchandise; no matter how dull or prosaic the base may be, making it saleable; how lacquer will protect and preserve the product—*in the ultimate consumers' hands;* how lacquer will *sell* an article and make it *stay* sold.

Latest Products

Each month the new products or services announced by companies in the metal and finishing equipment, supply and allied lines will be given brief mention here. More extended notices may appear later on any or all of these. In the meantime, complete data can be obtained from the companies mentioned.

Laboratory Colloid Mill; for making emulsions, dispersing dyes, pigments, lacquers, etc. Laboratory Equipment Co., 146 Lafayette St., New York.

Contour Sawing Machine; known as the Doall Contour Machine with a job selector dial to set the saw for correct sawing and filing speed; also selection of saw for correct pitch, temper and set. Continental Machine Specialties, Inc., 1301-5 Washington Ave. S., Minneapolis, Minn.

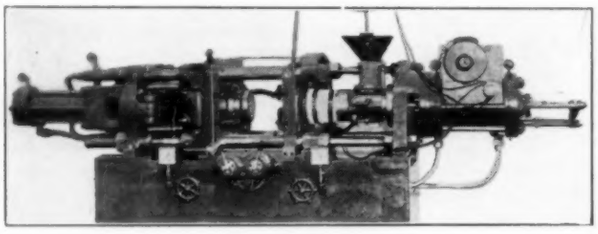
Laboratory Heaters and Hot Plates. Ful-Kontrol laboratory heater, adjustable from 0 to 750 watts for mild or intense heating. Precision Scientific Co., 1750 N. Springfield Ave., Chicago, Ill.

Front Drive Rivets; for maintenance and construction; applied from one side of job only by one operator. Multi-Seal Manufacturing Co., 123 N. Jefferson St., Chicago, Ill.

Brass Die Casting Machine

A new brass alloy die casting machine is announced by Reed-Prentice Corp., Worcester, Mass., called their No. 8G. This machine is the fourth in the line of brass casting machines and the largest. Die plates are 34 x 36 inches and space between bars is 20 x 22 inches. The die opens 12 inches and the maximum die space is 17 inches, minimum die space, with core cylinders is 7½ inches; without core cylinders, 5 inches. The machine which is 19′ long is operated by a 30 H.P. 900 R.P.M. motor to drive the oil pump which produces a line pressure up to 2,000 lb. per sq. in. and pressure on the metal up to 5,000 lbs. per sq. in.

The machine is semi-automatic in its operation, the operator throwing a lever to close the dies and cores. The second operation is to ladle the material into the metal cylinder, after which the operator steps on the pedal and operates the plunger, forcing the metal into the dies. From then on the cycle is automatic. The first period determines the time to pull the cores; the second allows time for cooling before opening the dies; the third allows the plunger to follow the moving die, forcing the metal slug out of the cylinder before it returns. The casting is ejected from the moving die at the end of its return stroke.



Reed-Prentice 8-G Brass Die Casting Machine

The manufacturers state that machines are in practical use for plumbing goods.

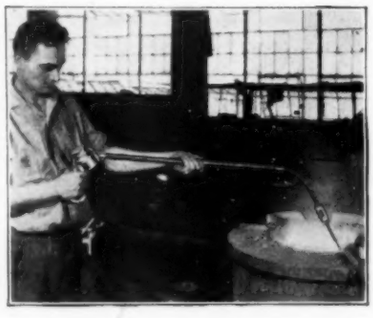
New Pyrometer

Tamms Silica Co., 228 N. La Salle St., Chicago, have introduced a new Pyramid Pyrometer. It works on the thermo-electric principle and features convenience of adjustment. Perfect calibration is said to be maintained constantly through thumb, screw adjustment on face of the dial. Heretofore it has always been necessary to send this type instruments back to the factory for checkup to maintain its accuracy.

Another advantage claimed is the new flexible end, adjustable to 180 degrees with perfect calibration. Customary swivel joints and brush or friction contacts have been eliminated thus minimizing the possibility of dirt deposits that hamper accurate readings.

All electrical parts and connections have been enclosed for positive protection. All parts inter-changeable for economy of maintenance.

There is the pistol grip handle for which comfort and ease of handling to the operator, houses the accurate, delicate mechanism of the Pyrometer. The pistol grip handle and indicating dial are arranged at such an angle that it makes possible, quick accurate readings without eyestrain or cramped posture.



Easy Calibrating Pyrometer

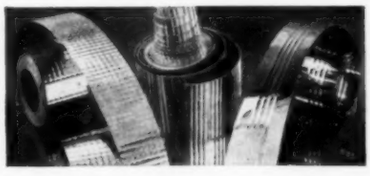
For further convenience, the base of the handle provides a good sized hole suitable for hanging instrument in a safe place on wall or post when not in use.

Crimped and Embossed Coils

The American Nickeloid Co., Peru, Ill., has announced a completely new idea in strip metal—crimped and embossed coils, completely prefinished, ready for continuous feeding to automatic machines.

In appearance, these new metals are unusual. Three striking patterns have been created: a deep vertical crimp, a 4-line parallel crimp with paralleling bands of plain metal at the sides, and a unique square crimp pattern having strong shadow depth and brilliant highlights.

The principal advantage claimed is economy, both in material cost and fabrication. This added to the ease of forming and stamping without need for further finishing operations, is reported to make possible cost savings as great as 50% on many stamped pieces.



Crimped and Embossed Strip

Intended principally for trim, these metals are also recommended for interiors and panelling.

Matching patterns are also available in sheets. Both the coils and the sheets are produced in basic metals of steel, zinc, brass and copper, with electroplated surface finishes of nickel, chrome, brass and copper—all polished to the highest possible commercial gloss.

Free samples of the new patterns are offered by the manufacturer to subscribers of this publication.

Convection Type Core Oven

Convection heating produces uniform, efficient and economical results for all heating operations between 200 and 1200° F. When used for heat-treating, a uniformity plus or minus 4° F. can be secured. In all baking and drying operations, moisture is removed rapidly by circulating the heated air at high velocities.

Core Oven Heated by Convection

In operations where volatile gases are given off, these can be safely incinerated in the air heater, removing the hazard always present in a direct-fired oven or dryer. If desired, indirect air heaters can be supplied, which prevent the products of combustion from contacting the work.

The Air Heater is described in Bulletin No. 535; Convection Heated Furnaces, Ovens and Dryers are described in Bulletin No. 1036, of The Philadelphia Drying Machinery Co., Industrial Furnace Divn., 3351 Stokley St., Philadelphia, Pa.

Spiral Screw Driver

A new type of spiral screw driver called the No. 33H Yankee Handyman is being offered by North Bros. Mfg. Co., Lehigh Ave. and American St., Philadelphia, Pa. This spiral ratchet screw driver includes right and left hand and rigid adjustments. It drives or draws screws simply by pushing on the handle and bores holes the same way using the Yankee chuck and drill in place of the blade.

Yankee "Handyman"

Temper Control Using the Comparison Microscope

There is an increasing tendency to control the temper of annealed materials by the use of grain size measurements. This procedure is applicable to metals or single phase alloys in which the physical properties vary with the grain size. Such control may be exercised as a check on the job by the producer or by the purchaser in testing his incoming materials.

The Busch comparison microscope, distributed by George Scherr Co., 128 Lafayette St., New York City, is designed for just such work. It can be used at the point of manufacture or at the point of inspection, eliminating the need for sending samples to the laboratory and the consequent loss of time and effort involved.

The control of the temper of annealed alloys, as described in Specification E2-36 of the American Society for Testing Materials, may be carried out by any one of three methods. The first is by comparison with standard micrographs showing pre-determined grain sizes. A disadvantage of this procedure is that the operator examines the unknown through the ocular lens of a compound microscope and then, taking his eye away from the microscope, attempts to retain the image of the micrograph in his mind in order to compare it with the standard photographs. The two micrographs cannot be examined at the same time.

The second method is the Jeffries or Planimetric, which consists of making a grain count of the image within a certain area on the ground glass screen of the camera.

The third is Heyn's or the Intercept method which consists of counting the number of grains on two axis of known length, which are at right angles to each other and averaging the grain count for the two directions. This may be accomplished on the ground glass screen or by use of a Filar eyepiece.

The last two methods are more accurate than grain size estimation, but are slow and cumbersome where a considerable amount of metal is being handled.

The Busch comparison microscope, it is claimed, embodies all the good features of the method using standard photomicrographs, without its shortcomings. Instead of a chart showing grain sizes of various magnitudes, a set of etched and lacquered metal standards is used of the same grain sizes as are illustrated in American Society for Testing Materials Specification E2-36. These standards are mounted on a revolving disc so that they can be observed in succession under one objective of the microscope without removing the eye from the ocular. The illustration shows how the unknown specification is placed under a second

Busch Comparison Microscope

objective, but by an ingenious arrangement of a sliding prism both the unknown and the standard may be brought into view simultaneously in the same eyepiece, equally splitting the two fields. By revolving the disc containing the standards, one of these will quickly be found which duplicates the grain size of the unknown material and from the grain size designation on this standard, that of the unknown will be determined.

For control work on annealed sheets, the preparation of samples for examination on the Busch microscope may be simplified to the following:

1. Cut specification from sheet.
2. Bend into rectangular shape over wood block of the same size as the projection on which it rests when undergoing examination.
3. Grind by hand on 5/0 Garnet paper.
4. Grind at right angles to previous direction on No. 280 Carborundum paper.
5. Polish quickly on a revolving canvas wheel using SFX emery and water.
6. Etch by instantaneous immersion in concentrated nitric acid. (Sp. Gr. 1.42).
7. Wash with water, dry on best grade of paper towel and examine under the microscope.

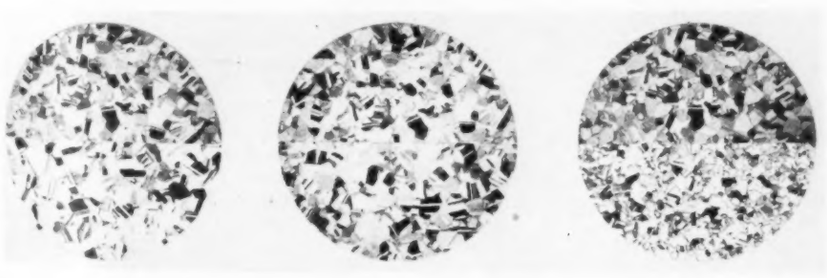
The total time for the procedure should not exceed 5 minutes. The etching solution recommended above is not standard for use with a metallurgical microscope but it produces an etch which is very rapid and in addition, appears to better advantage with the type of illumination which the Busch instrument contains, than the standard etch of hydrogen peroxide and ammonia.

An added advantage claimed for this instrument is that tubes and rods can be prepared for examination with a more simple procedure than when they are to be examined on the standard metallurgical microscope. Using the Busch microscope, due to the fact that with this particular optical system, the curved surface will appear as a plane, it is necessary only to prepare the outside surface by rubbing successively along one element with the two papers mentioned above, followed by rubbing with a small quantity of moistened SFX emery on the finger or a cloth pad followed by the same etching as is used for sheet. The piece is then inserted on the grooved side of the support reserved for the unknown and the grain size along the polished and etched element measured by comparing with the standard set of grain specimens as previously described.

Some of the advantages claimed for the Busch comparison microscope for grain size measurement are:

1. Reduction in time of preparation of samples.
2. Reduction in time for measurement of grain size.
3. Portability due to small size of the instrument allowing it to be used at the job instead of at the Laboratory.
4. Only method of obtaining a direct comparison of an unknown with any one of a series of standards without at the same time resorting to excessive manual manipulation.

Unknown *Unknown* *Unknown*



Standard—larger than unknown *Standard—same as unknown* *Standard—smaller than unknown*

Nickel Brightening Process

In a leaflet entitled, "Bright Facts About Nickel Plating," the Lustrebright Co. Inc., Fitchburg, Mass., describe a lustre-bright nickel brightening process, which it is stated, eliminates color buffing and burnishing. Articles to be plated, with chromium, can be transferred directly from the nickel to the chromium bath without intermediary buffing, re-cleaning or re-racking.

No changes in equipment or preparatory cleaning are required. It is claimed also that uniform results are obtained in still or mechanical plating; that all that is necessary is to add 1 gallon of Lustrebright per 100 gallons of the present nickel bath, and with the addition of a small quantity each week, maintain the desired brightness.

Lustrebright is guaranteed by the manufacturers not to harm the solution, not to cause the plate to peel or become brittle, and not to cause streaky deposits even if used in excess.

It is also recommended for bright plating die castings.

Bucket Trap

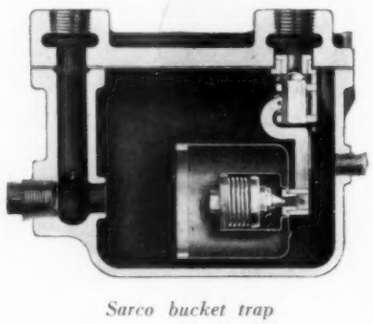
Sarco Company, Inc., manufacturers of steam specialties, 183 Madison Avenue, New York, announce the addition to their extensive line of steam traps of the new inverted bucket trap illustrated herewith.

This new trap uses the same valve mechanism as Sarco float-thermostatic traps. The trap can be furnished with integral air bypass carried inside the bucket and consisting of a regular thermostatic trap element of the balanced pressure type.

It is stated that this air bypass never requires setting and operates satisfactorily regardless of pressure fluctuations in the trap.

The makers point out that these traps were designed to complete their line but are in no way intended to compete with very light, low-priced units now on the market.

The bodies are of ample size and heavy design, as shown in the illustration. Traps are available in size ½" to 2" with bodies of cast iron for 125 lbs., semi steel to 250 lbs., and cast steel up to 500 lbs. steam pressure. Valve heads and seats in all types are of stainless steel.

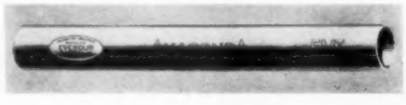


Sarco bucket trap

New Electrical Conduit

A new rustless, corrosion-resistant electrical conduit has been developed by the American Brass Co., Waterbury, Conn. It is made of Everdur metal and has been listed under "Factory Inspection and Label Service" by Underwriters' Laboratories as "Electrical Metallic Tubing." It is sold under the name "Everdur Electrical Conduit."

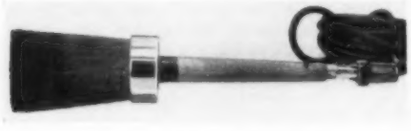
Everdur metal is, of course, absolutely immune to rust. It is almost highly resistant to a wide variety of corroding agents. Its strength is comparable to mild steel, and it is also tough, ductile and resistant to shock and stress.



Everdur conduit

A Brush Plating Apparatus for the Laboratory*

Even the best electrodeposits will finally succumb to the corrosive atmosphere of a laboratory. Chemists who formerly were resigned to see the bright plated parts of their apparatus and instruments take on a dull, corroded appearance can now easily remedy this situation, with little effort or expenditure, and without being deprived of the service of the instrument for days during repair.



An anode is mounted in the center of the brush

Brush plating, a unique electroplating process recently developed, now makes it possible to plate any metal parts, small or big, right in the laboratory, in a very short time, without the expert skill required in vat plating, without the use of any large cumbersome vat, with very small quantities of anode metal and plating solution, and without the obnoxious fumes evolved from the ordinary plating vat. Simplicity is the keynote of the process.

The laboratory brush plating apparatus consists of a low-voltage, 3-amp. rectifier which can be plugged into any ordinary outlet of a 110-volt, 60-cycle light circuit, and a brush, resembling a paint brush.

Mounted within the bristles of this brush is an anode of the metal to be plated, nickel, copper, tin, zinc or cadmium. This anode can be connected with the positive binding post of the rectifier by means of a 5 ft. rubberized cord equipped with a clip which is fastened to a metal connection at the end of the brush handle. The piece to be plated is connected to the negative binding post with a similar cord and clip.

The article to be plated is then placed in a glass tray containing a jelly-like solution of the metal used as anode; a small object is completely covered with this solution, a large object dips into it. The brush is then dipped into the solution and plied back and forth evenly and smoothly, very much in the manner used in ordinary painting, until a fine deposit is obtained. About five minutes are required to cover a surface of 10 sq. in. This is the largest surface that should be plated at one time. For larger surfaces it is necessary to overlap the portions plated to avoid the appearance of a joint.

The operator soon acquires sufficient skill to obtain an even, smooth deposit, of the required thickness. When the desired coating has been obtained the object is rinsed in water and wiped dry.

Any solution remaining in the tray is poured back into the jar and used in future plating. After use the brush with its anode is rinsed in water and hung up to dry. The anode should be kept in the right position, about one inch from the end of the brush. It goes into the solution very slowly but can be adjusted by loosening a set-screw and pushing it down from the end of the handle; anodes are easily inserted.

The cleaning of the object to be plated is a very important step in the procedure. The work must have a smooth surface, free from rust and pits, and must be polished and buffed if necessary. Grease and dirt must then be carefully removed. This is done in two steps, first by using a cleaning fluid, applied with a cloth, and next a cleaner, a paste, which is put on with a brush. The paste is then rinsed off in cold water. The surface, after cleaning must not be touched with the fingers.

Brush plating offers many advantages in electroplating instruments and laboratory appliances

Brush plating gives a coating equal in quality and appearance to the best obtainable by any other method. No peeling or stripping occurs. Very high current densities are possible, with greatly increased rates of deposition, as the replacement of electrolyte caused by the brushing action is far greater than that obtainable in vat deposition.

The Laboratory Brush Plating Apparatus, including the 3-amp. rectifier, 1 plating brush with nickel anode, 1 qt. of nickel electrolyte, cleaner, polish, and cleaning brush is obtainable for $39.50. Cost of accessories are as follows:

1 qt. Nickel electrolyte	$1.50
1 qt. Copper electrolyte	1.50
1 qt. Cadmium electrolyte	3.15
1 qt. Zinc electrolyte	2.25
1 qt. Tin electrolyte	2.50
1 Plating Brush without anode, for use with any listed below	5.00
1 Nickel anode	1.50
1 Copper anode	1.50
1 Cadmium anode	2.00
1 Zinc anode	1.50
1 Tin anode	1.50

A set of instructions, giving all details of the procedure is furnished.

*From The Laboratory, published by Fisher Scientific Co., 709 Forbes St., Pittsburg, Pa.

Rectifier Provides New Source of Direct Current

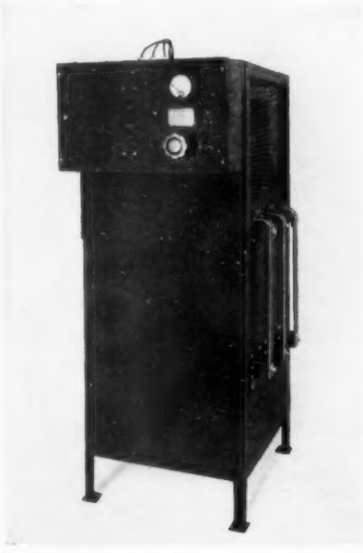
Copper Oxide Plate Type Rectifiers provide a new practical means of converting alternating current into direct current for use in the electroplating industry. This equipment is manufactured exclusively by the Hanson-Van Winkle-Munning Company, Matawan, N. J., in connection with the Westinghouse Electric and Manufacturing Company.

The numerous sizes offered provide a wide range of direct current supply for use in electroplating operations. The unit consists of power transformers, a small fan for air circulation, the rectifier unit and necessary control equipment. The outfit is also equipped with a De-ion circuit breaker which serves both as a switch and a protection against overloads and short circuits.

When installed where they are free from excessive humidity, dirt and fumes, it is said the equipment will give years of trouble-free service.

Freedom from moving parts, except for a small ventilating fan, is said to keep maintenance costs of Copper Oxide Plate Type Rectifiers at a minimum.

Installation cost is said to be practically nil as the outfit is simply placed into position as a self-contained unit. Additional features claimed for this equipment include a high overall efficiency and high power factor.



H-VW-M rectifier

Small Lot Burnisher

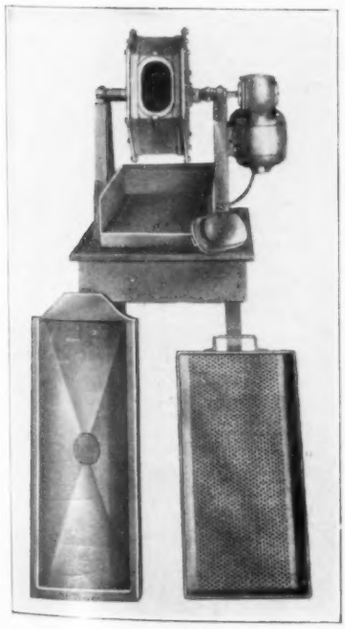
An important piece of equipment in the plating room is said to be the Belke small lot burnisher. This unit is designed to handle from a hand full to a peck of work at a time and produces the same finished job as the larger Belke Burnishers; made by the Belke Mfg. Co., 947 No. Cicero Ave., Chicago.

Large plating plants can use it for getting out sample jobs on estimates. Small plants can save the high cost of hand buffing. Even hotels and restaurants use it for brightening up cutlery.

This unit is designed ruggedly, for hard continuous use and is powered by fully enclosed, self contained geared-head motor.

The cylinder is lined with rubber and is 6" wide by 10½" in diameter.

In order to speed up loading and unloading the work pan has a perforated bottom. In this way burnishing balls are quickly separated by shaking back and forth. The ball container pan has a fine screen drain so that the water flows off. It is also equipped with a pouring lip so the burnishing balls can be easily returned to the cylinder. As said before this unit is one of the most important essentials of the plating plant and will save its total cost in a single month.



Belke small lot burnisher

Structural Metal Sections

Revere Copper and Brass, Inc., 230 Park Ave., New York City, have developed what is called the Revecon System of structural sections and metallic mastic. These extruded structural sections are designed to assist in the easy practical application and the permanent retention of any rigid flat sheet material, ranging from the thinnest decorative metal to a maximum of ½" in thickness, for exterior or interior use.

A wide range of flat sheet materials is available for selection in many colors, textures and panel sizes. Revere bronze, brass, copper and nickel silver sheets or chromium plated copper may be used; also aluminum, alloy steel or porcelain enameled panels are commercially available.

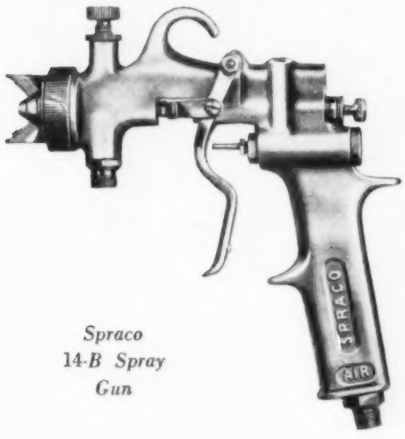
Revecon structural sections, it is stated, may be used as a coordinating medium for the application of these new panel forms, having integrally designed details incorporated in their shapes and requiring only the simplest field operations (notching and attachment) for their erection.

Revecon structural sections are now stocked and available at any of the Revere division mills. They are offered to the general building field.

A Revecon Handbook is issued by the company, giving details of the sections produced in various alloys and methods of assembling them.

Improved Spray Gun

A number of new features of design and construction have been introduced in the 14-B Spray Gun, just announced by the Spray Engineering Company, 160 Central Street, Somerville, Mass. The nozzle parts and inner connections are of stainless steel, and the fluid valve design has been improved to make control more fool-proof and accurate. The spreader has stainless steel inserts, and the air valve construction has also been redesigned.



Spraco 14-B Spray Gun

The one-piece gun-body is drop-forged aluminum, and according to the manufacturers, the 14-B is the lightest spray gun on the market. All fittings are chromium plated, giving the new gun an attractive appearance.

The Spray Engineering Company also furnish air compressors, automatic spray finishing machines, water washed spray booths, and accessory equipment for spray finishing departments.

Color Plating

An interesting new process, which is about to be introduced by United Chromium, Incorporated, 51 E. 42nd St., New York, is that for coloring metal articles. This process, which is covered by patents and patent applications, is said to make it possible to obtain, electrically, surface coatings of great brilliance and of almost any desired color or shade. It can be applied on articles of various types and descriptions, and on nearly all base metals.

The process, it is stated, has the advan-

tages of moderate cost of installation and operation, and great throwing power contributes to its flexibility and ease of handling. The trademark "Electrocolor" which is used in connection with articles colored by this process has been registered in the United States Patent Office.

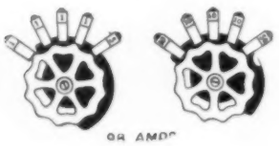
It is expected that a public announcement will be made in the not too distant future of the basis upon which this process will be made available to users throughout the country.

New Belke Rheostat

Perfect control of current is the secret of good deposits of metal. The rheostat by which current is controlled ranks next to the dynamo in importance in the production of quality and dependable plating.

For this reason the Belke Manufacturing Company, 947 N. Cicero Ave., Chicago, Ill., has designed the commutating type rheostat to give single step amperage control of current regardless of the total capacity of the unit.

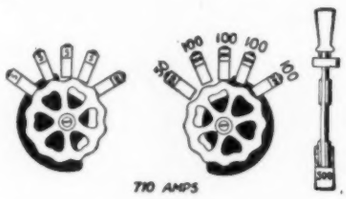
On this unit the first control has five high tension, spring clips for single amperage steps from one to nine. The second



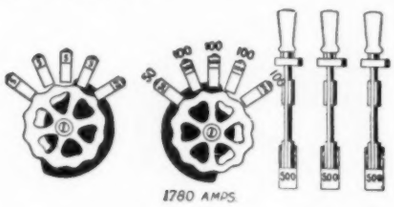
control is exactly similar in construction but each clip steps up the current 10 amperes at a time.

By using the first and second controls together the operator is able to get single amperage steps from 1 to 99.

On ordinary rheostats five knife switches are required to accomplish this capacity; even then, it may not be possible to obtain such accurate regulations. For example on the Belke Rheostat one can get 99 variations by merely twisting two dials, whereas five knife switches will only give 25 variations.



Where greater amperages are required, a third control comes into play. For example to obtain 332 amperes . . . control No. 1 is set for 2 amperes, control No. 2 at 30 amperes and No. 3 at 300 amperes thus giving 332 amperes.



When stages where over 500 amperes are necessary, a knife switch comes into use and the first control of single amperes is increased to 5 ampere stages because it is unnecessary to go to such fine extremes as single amperes.

1710 *ampere switch in service*

Air Drying Spot Welding Primer

The Sherwin-Williams Company, 292 Madison Ave., New York, announce an air drying spot welding black primer developed primarily for automotive production manufacturers. It is recommended for commercial body builders and repaint shops that specialize in metal body repair work, and all manufacturers who use welded construction.

Air Drying Spot Welding Black Primer X9185, it is claimed, solves the problem from rusting of lapped edges to be welded—a difficulty where partially fabricated parts are shipped or stored; also that it overcomes the problem of spot welding surfaces that are given coats of ordinary paint, enamel, lacquer or varnish. Such a film tends to insulate the metal surfaces with the result when sufficient current is used to weld the painted spots, so much heat is created the metal surrounding the painted area burns and gives a poor weld.

S-W Air Drying Spot Welding Black Primer, it is stated, has the following characteristics:

Reduction 150-200% with VMP naphtha. Xylol or toluol can be sprayed on sheet metal parts after.

Dries to touch in 10-15 minutes and handled for spot welding in 25-30 minutes.

Permits instantaneous spot welding with low voltage and low pressure. Eliminates burning away of paint surrounding the Spot Weld.

Prevents rust forming between the laps, the place where moisture accumulates and causes most damage to unprotected steel.

New Grinder

The No. 970G Grinder has been developed by the Chicago Pneumatic Tool Co., 6 E. 44th St., New York City, for general purpose grinding and with the proper wheel equipment, for wire brushing, buffing and polishing of metal surfaces in all types of plants.

Among the features claimed are wheel economy because of power sufficient to maintain high speed under load and freedom from dust troubles and overheating because of totally, enclosed fan cooled motor. The

Chicago 970 G grinder

switch is separately and totally enclosed. Two rows of ball bearings on work end of spindle have ample capacity for all radial and thrust loads. Every bearing has a ball bearing mounted in steel inserts and cast integrally.

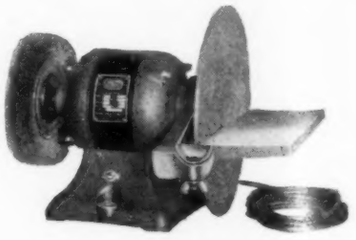
For full information write for Catalog 899 MI.

Grinding Machine

Chelsea Fan & Blower Co., 370 W. 15th St., New York, have developed a grinding machine which operates at 1750 r.p.m.

Standard equipment on this new machine includes the 12 inch disc faced with No. 50 Aloxite cloth, a hinged table, a 10 foot length of extension cord and plug but not the buffing wheel shown at the right-hand end of the unit in the illustration. The motor is a 1/3 H.P. enclosed unit equipped with SKF ball bearings. It is available for operation on specified voltage and 50 or 60 cycles. Control switch is rated at 10 amperes.

The table measures 8 inch in width by 12 inch from front to back. It is mounted

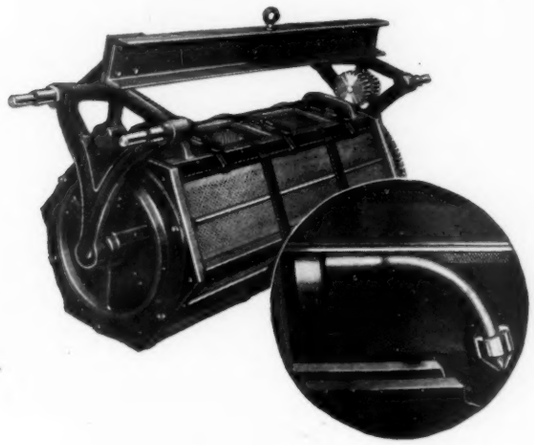


1750 *r.p.m. grinder*

in a pair of swivel sockets for setting square or at an angle with the face of the disc. It is held in desired position by means of wing nuts at the sockets. A second 12 inch disc and table can be provided to convert the machine to a double-disc unit. Also available is a guard and tool rest for use with a 6 inch wheel.

New Belke Plating Barrel

A new, more rugged plating barrel has been placed on the market after nearly four years of laboratory research and development by the Belke Manufacturing Company of 947 N. Cicero Avenue, Chicago, Illinois. Hundreds of different types of hard rubber fabrications were tested before Belke engineers developed the caustic resisting Mica Rubber of which this unit is made. This new product is said to be impervious to all solutions and to withstand any plating temperature without warping or buckling.



Belke plating barrel which incorporates a number of new features

An exclusive feature of Belke design is the method in which the cylinder walls are fitted to the barrel ribs. Here the construction provides much more wearing surface by machining the panels into the ribs at a 15 degree angle instead of the usual 45 degree. The barrel motion is also reversible so that when the gears and ribs begin to show signs of wear the motion may be reversed. This will enable a barrel to give much more service. Hard rubber coated steel girders encircle the cylinder for extra support. Heavy, hard rubber coated, steel reinforcements are also used for the two ribs on each side of the door. The hangers on the Belke barrel are bolted securely to the supporting bar with eight large steel studs, eliminating any possibility of weaving. The cover panel is held in place with sturdy, hard rubber covered spring clamps which are designed to make loading and unloading a matter of only a few seconds.

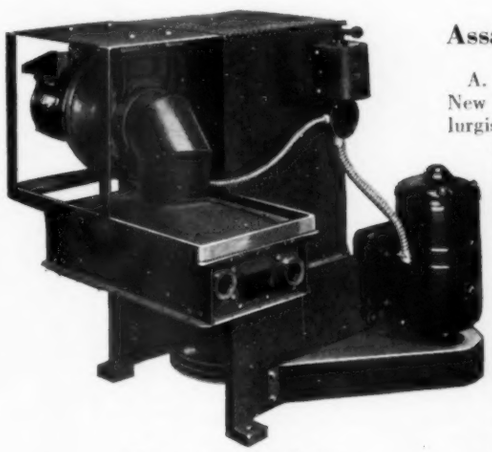
To provide high efficiency of current usage in the Belke barrel, there is one continuous, lead-in cable sheathed in layer upon layer of rubber. This eliminates intermittent contacts and, it is claimed, makes freeing impossible. The new cathode contacts are heavy, flexible, insulated cables extending from each end of the barrel. Large chrome plated steel knobs are at the ends. These bear down on the work to provide positive contact and uniform current distribution. This exclusive Belke feature eliminates danglers to prevent absorbtion of metal in the solution and speed up plating.

Another new and important feature in the construction of this barrel is that of replaceable bushings in the hanger where the small driving gears rotate. This enables speedy and economical replacement of only bushings instead of entire hanger construction. Bushings are also used where the barrel rotates on the hanger axle. When the bushing wears out, they can be replaced at small cost.

Centrifugal Dryer With Heater

This new Crown dryer is furnished with a self-contained heating unit and blower for supplying a volume of warm air to quickly dry specially hard jobs.

One inch thick, rolled steel is used in the main section of the base making it heavy enough to not only hold the machine down but to absorb vibration. There are no bolts, screws or small parts to shake loose. The weight of the base is 360 pounds.



Crown centrifugal dryer

In the construction of the Crown Centrifugal Dryer, Timken roller bearings are used. The bearings are protected from strain by a V belt Drive. The standard ¾ H.P. motor is equipped with a built-in magnetic disk type brake which operates automatically at the stopping and starting periods. The ball bearing motor is mounted vertically and protected from splash.

Both the frame which holds the basket and the basket itself are of welded construction throughout. The rate of drying is accelerated by means of a fan type arrangement made up of a series of blades welded to the outside of the basket frame. This feature combined with the flow of heated air, it is stated, substantially reduces drying time. The ¾ H.P. motor turns at 1750 R.P.M. which gives the basket 725 R.P.M. The basket is 12″ in depth by 12″ in diameter. With the heater the centrifugal dryer occupies a floor space 33″ by 44″ and weighs approximately 650 pounds.

It is made by the Crown Rheostat & Supply Co., 1908-1912 Maypole Avenue, Chicago, Illinois.

New Silicate Cleaner

A new type of industrial cleaner called Quaker Dri-Sil is now being manufactured by the Quaker Chemical Products Corp., Conshohocken, Pa. This material is a white granular powder with a bluish cast; a complex silicate containing less than 3% of moisture and approximately three times the Na_2O content found in sodium metasilicate. It is completely soluble in water.

It is recommended by the manufacturers for the degreasing of metals in tanks, with or without electric current and in washing machines. In some cases it is advisable to use soap in an alkali tank. In the case of the so-called soak solution, anywhere from 5 to 15% of anhydrous soap can be added to the Dri-Sil. Sodium resinate can also be used.

It is stated that Dri-Sil is a true chemical compound, and that the Na_2O is released continually in direct proportion with the silicate; that much smaller quantities of Dri-Sil can be used to do the same work as other compound cleaners.

Assayed Gold Plating Solution

A. Robinson and Son, 131 Canal Street, New York City, Gold Refiners and Metallurgists for the past 58 years, announce their new electroplating development—Robinson's Assay-Controlled Gold Plating Solution. This cyanide solution, it is claimed, offers great advantages to the production and job gold plater, as well as to the manufacturing jeweler, for the following reasons:

1. *It lasts longer.* Because of a special chemical reagent contained in it, the decomposition and oxidation of the cyanide is inhibited, thus giving the bath longer life, for there is no excessive formation of carbonates to reduce the efficiency of the bath beyond a workable point.

2. *It produces uniform results.* The yellow gold solution will plate out a beautiful uniform yellow gold over a wider range of conditions than has been possible up to the present. Any specified color gold solution will always plate the same color under the same conditions.

3. *The solution is "stabilized."* The solution, though containing cyanide, is stable and "electrochemically buffered." Because of the special reagent contained, the electrochemical potential between the alloying metals is "stabilized" and the color, which depends on the potentiometric relation between the alloying metals, remains constant over a wider range of working conditions and for a longer period of bath life.

4. *Simple to use.* There is nothing to add but water. Eliminates fuss, muss and waste. There is no handling of poisonous chemicals. The plater can spend his valuable time in plating, instead of tinkering with test tubes and acids, making his own.

5. *Concentrated.* The smallest bottle supplied, the 100 cc size, makes over a gallon of plating solution.

6. *Assayed.* The exact concentration of gold is stated on the bottle so that you know what you are getting for your money.

7. *Good for heavy or flash plating.* It will plate extremely heavy, durable coats of gold or flash on very thin acid-proof coats, depending on the dilution used and the time of bath exposure.

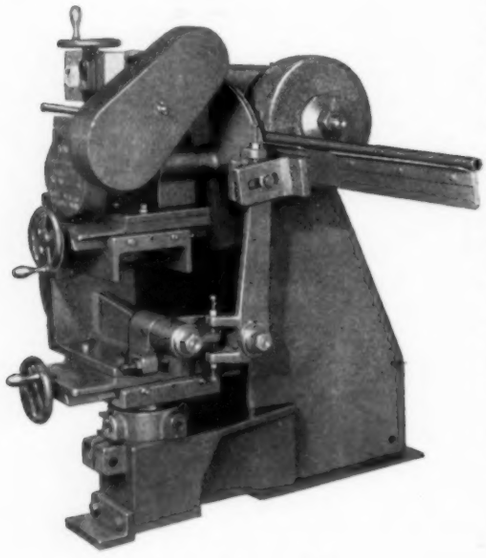
8. *High covering power.* Its throwing power is great enough to permit an almost instantaneous uniform covering of the most irregularly shaped pieces. Thus less gold is used up to get a uniform coating on the base metal.

9. *It offers accurate "gold control."* With the use of a graduate, exact additions and replenishments can be made. A bookkeeping record of the gold is thus made easier.

Automatic Tube and Pipe Polishing Machines

New machines added to the line of Acme automatic polishing and buffing machines are the Single and Three Wheel Automatics, Type "T" and Type "T-3" for polishing tubing and pipe; made by the Acme Mfg. Co., 1645 Howard St., Detroit, Mich.

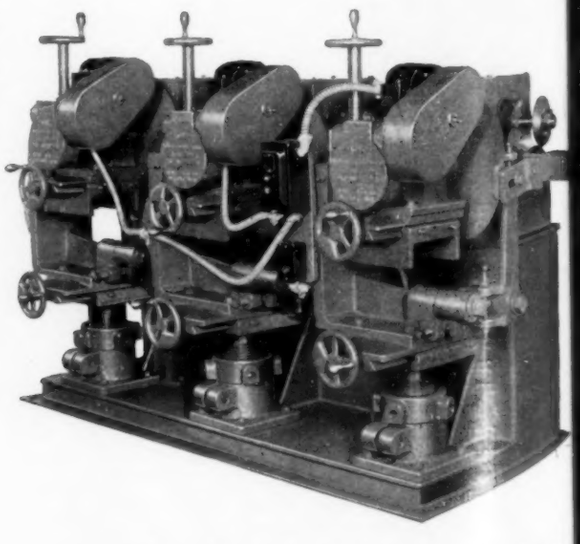
The Acme type "T" is a single wheel machine having a frustrum shaped feed disc, leather lined, which is vertically adjusted by the top hand wheel for setting the speed of feed of the tube or pipe from 0 to 20 or more feet per minute, and is driven by a totally enclosed ¼ H.P. motor and enclosed V-belt drive. The center hand wheel is used for tube size adjustment up to several inches in diameter. The lower hand wheel is for wheel wear and pressure adjustment. The polishing spindle is driven by either a 5 or 7½ H.P. totally enclosed fan-cooled motor, depending upon the nature of the work, and is adjustably mounted in a semi-enclosed steel fabricated base having a V-belt drive. The overall floor space is 50″ x 50″ and the net weight approximately 1,300 pounds.



Type T tube and pipe polisher

The Acme type "T-3" is a Three Wheel Machine used to perform *three* polishing operations in the *single* loading. The feed arrangement is similar to the type "T." The base consists of a single steel fabricated unit having three polishing spindles equally spaced and adjustably mounted, driven through a countershaft inside of the base, the countershaft driven by a 15 H.P. totally enclosed motor mounted on an adjustable base at the rear of the machine. Each polishing spindle is adjustable, so that polishing wheels that may vary in diameter, can be easily set into line, merely by adjusting a hand wheel. The total length of the machine is 78″ and the net weight approximately 3,500 pounds. This machine can also be built with more than three polishing spindles if desired.

Both machines are completely ball bearing equipped.



Type T-3; 3-wheel machine

Anti-Pitting Agent for Nickel Plating Solutions

Metanol an anti-pitting agent for nickel plating solutions is now being distributed by MacDermid, Inc., 526 Huntingdon Ave., Waterbury, Conn. Metanol is an alkyl aromatic sodium sulfonate, highly soluble in acid, neutral or alkaline solutions and stable. In addition it is said to possess strong wetting and emulsifying powers and in very low concentrations, to reduce the surface tension and interfacial tensions of solutions to a minimum.

The action of Metanol in the nickel plating solution, it is stated, is to reduce the interfacial tension between the bubble and the metal thereby causing the bubble to be released and to rise to the surface of the solution as soon as it begins to form, thereby preventing pitting. The nickel plate as a result is free from pitting and gas channeling; is whiter and brighter and has a finer grain structure; is relatively soft, making buffing easier; is extremely ductile when produced on current densities up to 70 amps. per sq. ft.; accepts chromium plate in the normal way.

The manufacturers also recommend the use of Metanol ¼ to ½ oz. per gal. in cathodic or anodic alkaline cleaning baths, stating that the cleaned work is easier to rinse and that the life of the cleaning bath is extended to about twice its normal length.

A full and detailed treatise on Metanol, its uses, functions, methods of control, regulation, etc., has been issued by MacDermid, Inc.

New Cleaning Compound

A metal cleaning compound known as Clenesco Enamel Cleaner has been announced by the Cowles Detergent Company, 10525 Carnegie Avenue, Cleveland, Ohio.

It is said that after several months active effort on this cleaner, it has been found to have a very definite place in the porcelain enameling industry and is being used in plants manufacturing reflectors, stoves, hollow ware, thermometers and other articles with a porcelain enamel finish.

(Continued on page 187)

The drawing compounds on deep drawn work as well as mill oil and other lubricants used in fabrication are said to be removed successfully in the usual time allotted for cleaning in enameling plants.

It is also claimed that Clenesco Enamel Cleaner rinses easily and has been found to be most economical due to the fact that it may be worked for long periods before it is necessary to dump the tank.

It is the policy of the Cowles Detergent Company to arrange for demonstrations of Clenesco Enamel Cleaner without cost for material used.

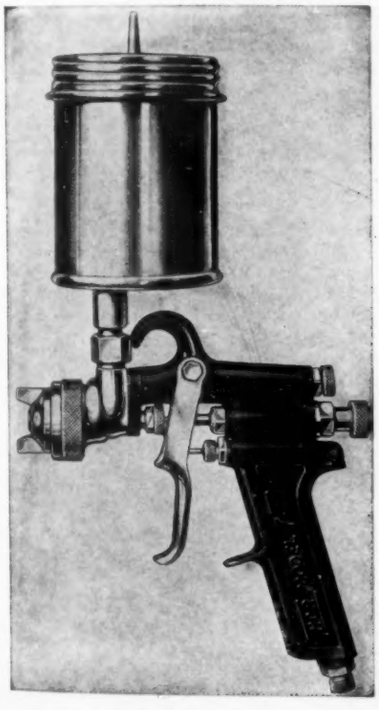
New Spraying Equipment

The Binks Mfg. Co., 3114 Carroll Ave., Chicago, are offering several new items of equipment for spraying.

Top Feed Spray Gun

A new Top Feed Spray Gun, known as the Binks Thor 7-F is a special gun designed for laboratory use to duplicate gravity feed conditions, and for materials of such nature that they cannot be sprayed with the ordinary syphon spray gun.

It is said to be ideal for ceramic materials, as well as for hammered silver, bronze and gold type finishes.



Top feed spray gun

The Thor 7-F is made with either straight top feed or angle top feed cup, which has a capacity of one pint. The purpose of the angle top feed is to enable the operator to tip the gun almost at right angles without any danger of spilling the material in the top feed cup. Otherwise cup and gun are identical.

Spray Gun for Medium Heavy Materials

A new spray gun of the external atomization type for medium heavy materials is known as the Thor 7-D.

This new gun will spray cut-back asphalts, sound deadeners, insulating materials, roof and car cements, also heavy stucco and cement paints.

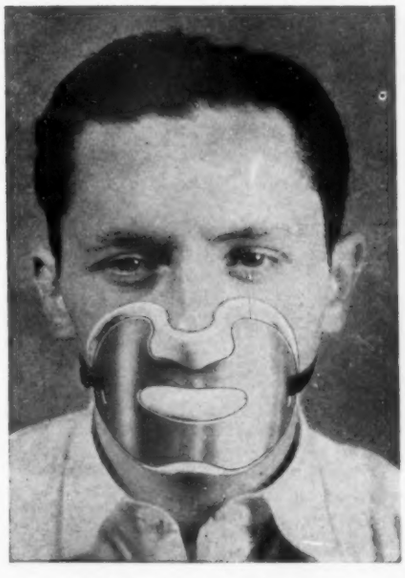
Spray gun for medium heavy materials

Mechanism and body of the gun are the same as on the Standard Thor Model 7. Material connection is standard ½" male pipe thread. Air connection is standard ⅜" male pipe thread. Adapters to any size thread can be furnished on request.

New Type Respirator

A new, light weight, low priced respirator has been added to the line of spray equipment and accessories.

Known as Binks No. 10 Pad Type, the new respirator consists of a flexible aluminum frame which holds a specially treated pad over the operator's nose and mouth, conforming to contour of the face. It is said to have excellent protective features combined with extreme lightness. Pads are easily replaced and are very reasonable in price. Permits full vision and unhampered working freedom.



Light weight respirator

Automatic Turntables for Spray Finishing

With Binks Air and Electric Motor Turntables the article which is being finished, when placed on the turntable, can be revolved in front of the operator without loss of time or effort by simply pressing the foot pedal controlling the motor.

By means of the Air Regulator on the air operated model the revolving turntable can be set at any desired speed. On the electric model the speed is regulated by a variable speed pulley. The motor itself is totally enclosed to protect it from paint and dirt.

Automatic turn-table

The handy foot pedal, giving instant stop and go operation, leaves both hands free to handle the spray gun and the object being sprayed without wasting time.

The revolving turntable disc may be furnished round or square from 8 to 24 inches in diameter. The standard height of the turntable is 30 inches, but may be made higher or lower as specified.

"Camelyte"—A New Finish for Metals

For more than three years, chemists in the laboratories of the Plating & Galvanizing Company, Broadway and Henry Street, Cleveland, have worked to develop a finish for metals that would be an improvement both in beauty as well as durability on any of those finishes used heretofore for commercial purposes. Recently they announced that a new finish called "Camelyte" was ready for the market.

Camelyte, it is stated, is an exceptionally bright and hard finish much whiter than chromium and although often compared to highly polished silver, considerably more brilliant than this metal. In the electrolytic bath it is deposited in a very close grained structure, forming a protective coating that is virtually fused to the base metal. It is claimed that no amount of twisting, bending or severe use will cause it to crack or chip off. The fact that Camelyte is applied direct to the base metal, eliminating the costly preliminary platings which are always a part of the chromium process is also a claim from the standpoint of economy.

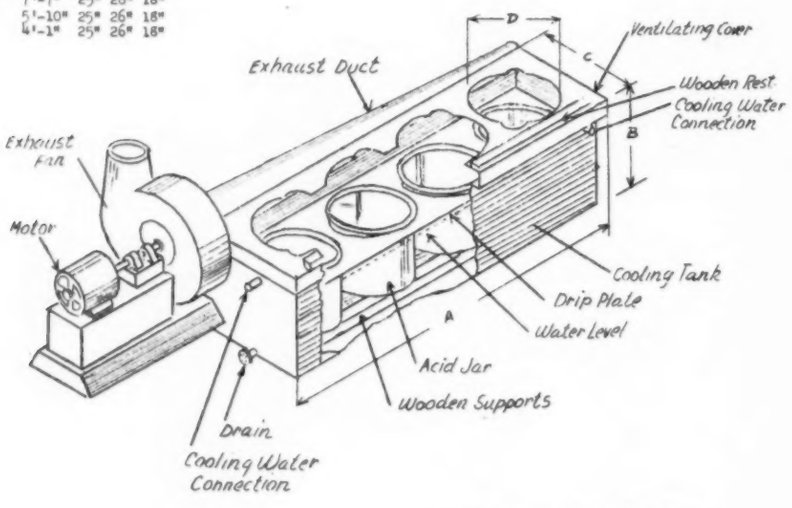
This finish, it is said, provides an exceedingly serviceable rust proof coating. In accelerated corrosion tests it has been subjected to a strong salt water solution for a period of 500 hours without showing the slightest disintegration. Samples of it have been left out-of-doors to determine what the corrosive affect of the atmosphere would be. After more than a year and a half, there is no indication whatsoever of corrosion attacking Camelyte finish. It may become dull but its brightness is easily restored again with a little polishing.

Camelyte is recommended by the manufacturers as an excellent protective finish for a great variety of articles ranging from small hardware fittings to metal furniture.

Small Parts Pickling Units Goodyear Plioweld Lined

The need for a standardized "small parts" pickling unit prompted The Goodyear Tire and Rubber Company, Akron, O. to design and offer to the trade such a unit as is shown herewith.

Unit	A	B	C	D
4	7'-7"	25"	26"	18"
3	5'-10"	25"	26"	18"
2	4'-1"	25"	26"	18"



The Goodyear Tire & Rubber Co., Inc.
Akron, Ohio

Small parts pickling unit

All fumes are kept under control. This is accomplished by an integral exhaust system of such capacity as to create a draft of sufficient strength across the tops of the acid jars so that very nearly all fumes are disposed of, thus preventing their entrance into the room to irritate the workmen and to corrode other equipment.

Reaction temperatures are also controlled. This is effected by the circulation of cold water around the acid jars. The excess running water capacity is sufficient to prevent any undue temperature rises in the jars.

Acid spillage is promptly diluted and washed away. Drippage from the dip basket as it is lifted from one jar to the next goes immediately into the large water supply unit where dilution is immediate and effective.

Work loss from spillage is reduced. A convenient rest plate is provided, extending along the entire front of the unit where the dip basket may be placed as needed when transferring from one jar to the next. Pieces which are spilled from the dip basket are caught up by the Plioweld covered drip plate with the exception of those which fall directly into the jars.

The cooling tank proper is constructed from No. 11 ga. sheet steel with all seams welded. The interior is lined with ⅛" Plioweld and the exterior is finished with black Pliolite, an acid and alkali resistant paint developed by Goodyear.

Aluminum Reflectors

Aluminum reflectors designed to properly distribute light from the 400-watt high intensity mercury lamp where the mounting height is 18 feet and over, have been announced by the Westinghouse Electric and Manufacturing Company, E. Pittsburgh, Pa. These units are particularly suited for the general lighting of foundries, machine shops, stamping departments, power plants, receiving and shipping departments and sheet metal departments.

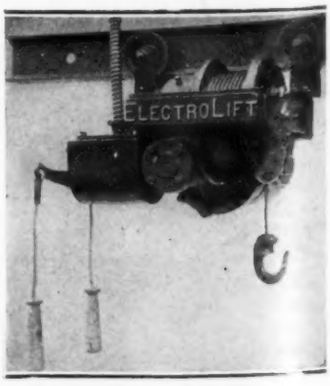
Aluminum light reflector

The high mounting reflectors are made from 14 gauge commercially pure aluminum sheet. Their shape is such as to make them especially strong and durable after fabrication. A special Mogul type socket is rigidly mounted in the hood to properly position the lamp in the reflector.

High Speed Close Headroom Hoist

The new high speed closed headroom Junior Type Hoist built by Electro Lift, Inc., 30 Church Street, New York City, shown in the picture below, has a hoisting speed of 60 feet per minute and is built in sizes of 250 lbs., and 500 lbs. It is particularly recommended for handling, rapidly, small loads in volume production, saving very much time over hand labor. It has been used in many divisions of the automobile plants such as lowering engines, radiators and other parts into the chassis; for loading and unloading freight cars and for serving conveyor lines. It has also been used in refrigerator manufacturing, assembly, testing, shipping and for dumb waiter lifts. Also, for over pickling and dipping tanks and wherever high speed is essential.

This hoist has worm drive with worm and wheel running on Timken tapered roller bearings, fully enclosed within the gear case



High speed industrial hoi

and operating in a bath of oil. This provides simple construction and quiet operation. The motor has ball bearings and is directly attached to the hoist frame giving a compact arrangement. This hoist has a very close headroom between hook and overhead track. The control may be either rope type or push button type, the latter giving accurate control of the load by jogging.

Protective Coating

Evans-Walton Co., 243 W. Congress St., Detroit, Mich., announces a new transparent protective coating for all bright metal surfaces. This coating, applied as a liquid, is said to harden quickly and become a tough adherent top layer, which will preserve indefinitely the natural lustre of the polished metal. It can be applied with an ordinary brush.

Cellufoil is recommended as a protective against the destructive action of salt in ocean or the salt which is placed on city streets in winter to melt snow. It is not a lacquer or polish; not for use on painted, enameled or lacquered surfaces. Its primary function is as a protective coating on any exposed metal parts, such as automobile, marine, etc.

Improved Sulphur Cement

Tegul-Vitrobond is the name given by the Atlas Mineral Products Co., Mertztown, Pa., to the new sulphur cement developed at the Mellon Institute of Industrial Research in Pittsburgh. It is used as the jointing material in acid-proof tank masonry construction and has the following physical and chemical properties.

1. Inert to hydrochloric, sulphuric, acetic, lactic and phosphoric acids; to nitric acid up to 30%; to hydrofluoric acid (Carbo-Vitrobond). Tegul-Vitrobond is not recommended for storage of chromic acid or concentrated alkalies.
2. It does not deteriorate or alter with age.
3. Tensile strength 600 lb. per sq. in. and compressive strength of 6,000 lb. per sq. in.
4. High resistance to thermal and mechanical shock.
5. Shows little or no erosion under turbulent liquids.
6. Easy to apply and ready for service immediately after solidification in the joints.
7. It is recommended for electrolytic tanks, pickling, tanks, acid-proof flooring, ducts, gutters, stacks, etc.

New Books

Book of A.S.T.M. Standards. Part 1. Metals. Published by the American Society for Testing Materials. Size 6 x 9, 898 pages. Price $7.50.

The American Society for Testing Materials has just issued its 1936 Book of A.S.T.M. Standards. This triennial publication contains all of the standard specifications, methods of test, recommended practices and definitions formally adopted by the Society. The 1936 issue is in two parts—Part I giving in their latest form all A.S.T.M. standards covering metallic materials; Part II, all standards relating to non-metallic materials. Both parts aggregate 2,400 pages.

Part I on Metals

Of the 181 standards in Part I, 109 cover the ferrous metals, steel, wrought iron, pig iron and iron castings and ferro-alloys, while 60 relate to non-ferrous metals, including aluminum and magnesium alloys, copper and copper alloys, lead, nickel, zinc, bearing metals, solder metal, deoxidizers, electrical-heating and electrical-resistance alloys. Twelve of the standards involve metallography and general testing methods.

In the section of Part I devoted to ferrous materials (109 standards) a specification for zinc-coated steel and iron articles is included.

The 60 standards relating to non-ferrous metals are grouped according to the following classifications:

Aluminum Alloys
Copper and Copper Alloys (copper ingot; brass and bronze; copper and brass plates, tubes, rods, etc.; copper wire and cable)
Lead
Nickel
Solder Metal
White Metal (Bearing Metal)
Zinc
Deoxidizers
Electrical-Heating and Electrical-Resistance Alloys

Other standards in Part I cover grain size for classification of steels, metallographic testing of steel and of non-ferrous metals and alloys, radiographic testing of metal castings, thermal analysis of steel, Brinell and Rockwell hardness testing, tension testing of metallic materials and definitions of terms relating to (1) metallography, (2) methods of testing and (3) specific gravity.

New Metals Standards Adopted in 1936

During 1936 many new standards were adopted relating to widely used materials. In Part I, the following materials are covered by new specifications:

Zinc-Coated (Galvanized) Wrought-Iron Sheets
Copper-Base Alloys in Ingot Form for Sand Castings
Bronze Trolley Wire
Rockwell Hardness Testing

Standards in Part I (Metals) in Which Revisions were Adopted During 1936

Revisions in some 35 of the existing standards covering metallic products were adopted during 1936. Materials covered by these standards include the following:

Aluminum Bronze Castings
Steam or Valve Bronze Castings
Copper Trolley Wire
Resistivity of Metallic Materials (Test)
Metallographic Testing of Metals

Book of A.S.T.M. Tentative Standards. Published by the American Society for Testing Materials. Size 6 x 9; 1,390 pages. Price $8.00 in cloth or $7.00 in heavy paper cover.

The 1936 edition of the Book of A.S.T.M. Tentative Standards (1,390 pages) contains 264 tentative specifications, methods of test and definition of terms covering widely used engineering materials. A large number of the standards are included in this publication for the first time, having just been approved during 1936 and a number were revised during the year and are given in their latest approved form. The general classification of the items follows:

Ferrous metals (forgings, castings, pipe, etc.)	47
Non-Ferrous metals (aluminum, magnesium, copper and copper alloys, zinc, die castings, etc.)	33
Paints, varnishes, lacquers and paint materials; waterproofing and roofing materials	27
Miscellaneous materials and general testing methods	20

New tentative specifications published for the first time in 1936 cover the following non-ferrous materials: uniformity tests, by the Preece method, of coating on zinc-coated iron or steel wire; hard-drawn copper alloy wires for electrical conductors; sheet and strip phosphor bronze; seamless copper-nickel alloy condenser tubes and ferrule stock; magnesium-base alloy bars, rods and shapes; test for deflectivity of thermoflex (thermostatic metals).

Metallurgical Abstracts (General and Non-Ferrous). Published by the Institute of Metals (Great Britain). Size 5½ x 8½, 890 pages. Price £4 inclusive of the two Proceeding Volumes.

The second volume of its kind issued by the Institute. It contains over 10,000 abstracts covering properties of metals, corrosion and protection, electrodeposition, refining, analysis, apparatus and instruments, testing, temperature and fuels, refractories, heat treatment, working, joining and the cleaning and finishing of metals.

Show Schedule for 1937. Published by Exhibitors Advisory Council, Inc. Price $5.00.

A complete schedule of shows, expositions for 1937 covering industrial, trade, agricultural, professional, medical, business, etc., is available for general distribution. The list contains names, dates and locations of 1937 exhibits. The index of classification includes the following:

The Mineral Industry During 1935. Edited by G. A. Roush. Published by McGraw-Hill Book Co. Size 6¼ x 9, 754 pages. Price $12.00.

Volume 44 of this annual publication which is recognized as the standard for its field. Its broad coverage of statistics, technology and trade for both the domestic and foreign field makes it of special value to those interested in the mineral industries.

This volume is of particular interest because of its expanded sections on foreign mineral resources and other data. Another important feature is the excellent section on gold and silver which brings out in sharp relief, the world's financial status, presenting very full statistical data.

National Metals Handbook, 1936 Edition. Published by American Society for Metals. Size 6 x 9, 1,392 pages. Price $10 to non-members A.S.M.

The Metals Handbook is a comprehensive volume of metallurgical practice covering subjects pertaining to manufacture, treatment and use of metals. It is the work of no single individual but of a committee aided by a large number of specialists. The goal of the publishers is to make the handbook a complete book of reference on the subject of metals.

The subject matter is arranged under several major headings which are: General Data; Testing; Heat Treatment; Welding and Cutting; Processes, Methods and Equipment; Definitions, Trade names and Weights. A large section of the handbook is devoted to non-ferrous metals covering aluminum, cadmium, calcium, copper, gold, lead, lithium, magnesium, nickel, platinum, tin, zinc and their alloys.

This volume is an indispensable part of the library of everyone directly or indirectly connected with the metal or metal products manufacturing industries.

Copper for Bus-Bars. Published by the Copper Development Association, Thames House, Millbank, London, S. W. 1, England. Size 6¼ x 8, 161 pages.

This book is neither a catalog nor the usual type of trade publication. Its intention to be a comprehensive and up-to-date technical book summarizing the latest information on this subject. No charge is made for it to responsible engineers or those genuinely interested in the industry.

Subjects covered are the following: Copper for Bus-Bar Purposes; The Current Carrying Capacity of Bus-Bars; Alternating Current Bus-Bars; Electromagnetic Stresses in Bus-Bars; The Jointing of Copper Bus-Bar Conductors; Indoor and Outdoor High Voltage Bus-Bars; Thermal Expansion of Bus-Bars—Choice of a Bus-Bar Material; Useful Information and Tables; Bibliography; Index.

Mines Register and Metal Handbook. Published by Atlas Publishing Co., Inc. 2,000 pages. Price $25.

The Mines Register and Metal Handbook lists and describes about 10,000 copper, gold, silver, lead, zinc and other non-ferrous metal mining companies in North and South America, giving the history and development of the company, a geological report on the property, a description of its equipment and machinery, its production record for a number of years, its financial report over a period of years, the names of the officers of the company, its headquarters and branches and the names of the operating officials.

Special sections of the *Mines Register* contains non-ferrous metal statistics on production, consumption and prices of gold, silver, copper, lead, zinc, aluminum, quicksilver, etc., also a list of consulting mining engineers. A comprehensive list of manufacturers and suppliers of equipment and machinery used in mining operations is also included.

Nema Electric Arc Welding Machine Standards. Published by National Electrical Manufacturers Association. Size 8 x 10½, 19 pages. Price 50 cents.

This is a reference work of practical information concerning the manufacture, test and performance of direct current and alternating current arc-welding machines, such as motor generator sets, dynamotors, transformers and rectifier arc-welding units. It represents standardized practice in the United States.

Symposium on High Strength Constructional Metals. Published by American Society for Testing Materials. Size 6 x 9, 126 pages. Price $1.25 in paper binding; $1.50 in cloth binding.

This symposium comprises five extensive technical papers and discussion presented at the 1936 A.S.T.M. regional meeting. The papers cover the chemical and physical properties and manufacturing and fabricating properties of metals and alloys applied for various constructional applications including buildings, ships, automobile bodies, airplane wings, tanks, etc.

The papers give the latest information and data on the following: carbon and low-alloy steels, corrosion-resisting steels, alloys of copper, alloys of nickel, and alloys of aluminum and magnesium. There are a great many charts and tables of data in the symposium, thus presenting much of the valuable and extensive information in condensed form.

Technical Publications

Brass Pressing, published by Copper Development Association, Thames House, Millbank, London, S. W. 1, England. Of interest to those who are engaged in the design or use of the many products which are now cold-formed from strip and sheet metal.

Aluminum Industry. A special issue of "The Times," (London, England) Monthly Review of Industrial Progress, with an aluminium section. A number of articles by world authorities in this industry, including Arthur V. Davis, Chairman of the Board of the Aluminum Co. of America.

Seventh Report of the Committee on Atomic Weights of the International Union of Chemistry, by G. P. Baxter, O. Honigschmid and P. Lebeau. Secretariat General 28, Rue Saint-Dominque, 28, Paris, France.

Goggles. Safe Practices Pamphlet No. 14. Published by National Safety Council, Inc., 20 N. Wacker Dr., Chicago, Ill.

Discoloration and Corrosion in Canned Cream, by C. J. Jackson, G. R. Howat and T. P. Hoar. International Tin Research and Development Council, 149 Broadway, New York City.

Government Publications

The Realities of Unemployment by Harry L. Hopkins, Administrator Works Progress Administration, Washington, D. C.

Analysis of State Unemployment Compensation Laws. January 1, 1937. By R. Gordon Wagenet and M. G. Murray. Social Security Board, Washington, D. C. Obtainable from the Superintendent of Documents; price 15c.

Associations and Societies

American Electro-Platers' Society

90 Maynard St., Springfield, Mass.

Intelligence Test!

The following mental test is designed to test the alertness of A. E. S. members. Follow directions. If you make a perfect score (100 points) you are entitled to a drink on the house.

I—Information Test—Underline the correct words to complete thought:

(a) In the spring a young man's fancy lightly turns to thoughts of—*Beer, Love, Sleep.*

(b) June 14, 15, 16, 17, 1937 will bring to New York City—*Blizzard, A.E.S Convention, Alfalfa Crop.*

(c) The Pennsylvania Hotel has been chosen by the Convention Committee as—*Aviation Field, Convention Headquarters, Beer Warehouse.*

(25 points)

II—Best Reason or Comprehension Test—Check the best reason:

A. E. S. Members and friends should attend the 25th Annual Convention because:

(a) It is being held in New York City.

(b) They can expect the time of their lives.

(c) It is the Silver Jubilee and Oh Boy!

(d) Boy, will they be sorry if they miss it!

(25 points)

III—Proverb Test: Match the following proverbs with the statements that explain their meaning:

(a) Proverbs

There is no smoke without fire.
A word to the wise is sufficient.
A friend in need is a friend indeed.
One good turn deserves another.

(b) Statements: mark the following statement which explains above proverb.

The 25th Annual Convention is now the burning question.
New York City in June is a wonderful place.
The New York Branch depends upon the A. E. S.
What one elbow bender says to another at conventions.

(50 points)

Add up your score. If you find it perfect make your reservation for the *Convention now*. If you score is not so hot—make your reservation anyway. After all who's perfect?

1937 CONVENTION COMMITTEE
Louis H. Cates
Publicity Chairman.

Boston Branch, A.E.S.

c/o W. Garrett, 100 King St., Dorchester, Mass.

The Boston Branch of the American Electro-Platers' Society held a very successful open meeting and banquet on Saturday, March 6th. The educational program included papers by W. E. Bancroft of Pratt & Whitney, Hartford, Conn. on *"Hard Chromium Plating"*; Benjamin McGar, Chase Brass & Copper Co., Waterbury, Conn. on *"New Developments in Copper Alloys"*; W. M. Phillips, General Motors Corp., Detroit, Mich., on *"The Actual X-Ray of Plating Solutions."*

The banquet and the rest of the evening were enlivened by a floor show composed of outstanding professional talent and of course, the banquet. The day was a perfect combination of time spent profitably and enjoyably.

Milwaukee Branch

c/o A. J. Hermansen, 539 N. 99th St., Wauwatosa, Wisc.

The Milwaukee Branch of the American Electro-Platers' Society will hold their annual educational meeting and smoker at the Schroeder Hotel (Crystal Ballroom) and all platers and manufacturers interested in electroplating are cordially invited. A fine educational program has been prepared.

1. *The Control of Electrodeposits*, by Wm. Geisman.
2. *Silver Plating Wire for the Manufacture of Tinsel Products*, by Max Ackermann.
3. *Problems in a Modern Plating Department.* To be read by Phil Ritzenthaler; a joint paper by the staff of Cutler-Hammer, Inc.
4. *George B. Hogaboom* of the *Hanson-Van Winkle-Munning Co.*, will also address the meeting.

A question box session will be held.

The educational program will be followed by entertainment and a buffet lunch with plenty of the refreshment for which Milwaukee is famous. Tickets, $2.00 per person.

Newark Branch, A.E.S.

c/o George Wagner, 1134 S. Long Ave., Hillside, N. J.

The Newark Branch of the American Electro-Platers' Society will hold its annual open educational session and banquet at the Douglas Hotel on Saturday, April 10th.

Details of the program have not yet been completed but knowing the Newark Branch affairs, it is safe to predict that this will again be one of the outstanding events of the season.

International Fellowship Club

The International Fellowship Club will hold a luncheon on April 10th at the Hotel Douglas to discuss the Open House to be held at the annual convention in New York in June. All supply manufacturers and representatives are urged to be present.

New Haven Branch, A.E.S.

c/o C. H. Costello, 1285 Boulevard

The first meeting of the newly formed New Haven Branch American Electro-Platers' Society was held on Friday, March 19, 1937.

Arrangements have been made with Yale University to hold meetings at the Sterling Chemistry Laboratory on the first and third Tuesday of every month. The University has promised every cooperation to the branch. Instructors and professors are available for lectures, and a laboratory course is promised for the fall.

At the opening meeting the following were appointed to act as temporary officers until the regular elections in May:

President—Wm. Bridgett, 286 Ward St., Wallingford.
Vice-Pres.—Jos. Downes, Remington-Rand, Middletown.
Sec.-Treas.—C. H. Costello, 1285 Boulevard, New Haven.
Librarian—T. H. Chamberlain, 97 Canner St., New Haven.
Sgt. at Arms—J. Barry, 33 Maple St., West Haven.

Board of Managers:—
John Oberender, Leroy Brown and Albert Rosenthal.

Officers for the year 1937-38 will be recommended by the following nominating committee—Tom Chamberlain, Bob Mooney, Al Jaekle, Jack English and Joe Sexton.

Business meetings of the Branch will be held regularly by the Officers and Board of Managers. Any member may attend. These meetings will precede the regular meetings which are scheduled to start promptly at 8 P.M.

The following were appointed to the sick committee—

Bob Mooney, Jack English and George Knecht.

Chairman of the membership committee is Joseph Downes and every member of the branch is a member of the membership committee.

As Librarian, Tom Chamberlain is in charge of the programs to be presented by the Branch. Tom is at present lining up a series of talks on Base Metals to be given by a Yale instructor during the next few months. It is expected that a definite program will be planned for every meeting.

A very welcome guest at our first meeting was Bill Kennedy, Executive Secretary of the A.E.S. Bill gave us a good deal of sound advice and we all appreciated his interest in our welfare.

The New Haven Branch is starting off with a membership of thirty members, and we expect to add considerably to our numbers soon as there are a large number of eligible men in the vicinity.

Requests for membership application blanks should be addressed either to Joe Downes or to the Secretary.

The New Haven Branch will join forces with the Bridgeport Branch and hold a spring banquet and open educational session on May 1st. The educational session will be held in the Stratfield Hotel, in the afternoon. Walter Meyer will be in charge.

The banquet will also be held in the Stratfield Hotel and there will be the usual good food, dancing, entertainment, prizes, etc. Tickets $3.00.

Information about the banquet can be obtained from John English, 8 Colony Rd., Ansonia, Conn.

Connecticut Non-Ferrous Foundrymen's Association

c/o L. G. Tarantino, 565 W. Taft Ave., Bridgeport, Conn.

At a regular monthly meeting, held Tuesday, March 16, 1937 at the Hotel Duncan, New Haven, Conn., presided over by President, T. Joseph Judge the Association was addressed by Dr. A. S. Gray of Hartford, Conn., Director of the Bureau of Occupational Diseases of the Department of Health of the State of Connecticut.

The subject of his talk was: *"Silicosis and Occupational Diseases."* He was very instructive in pointing out the merits of good house-keeping in the foundry, making suggestions toward dust control and reducing the silicosis hazard in the foundry. His talk was well received by an attendance of 46 foundrymen.

The next meeting April 20th, to be held at the same place will be addressed by a representative of the Osborn Mfg. Co. of Cleveland, Ohio who will talk on *"Molding Machines and Their Application to the Non-Ferrous Foundry."*

American Zinc Institute

60 E. 42nd St., New York

The 19th Annual Meeting of the American Zinc Institute will be held at the Hotel Statler, St. Louis, Mo., on April 26 and 27. A part of the program will give an intimate picture of new developments in zinc merchandising and the producing of zinc and zinc coated products.

Galvanizers Committee

The second meeting of the Galvanizers Committee sponsored by the American Zinc Institute, will meet at the Hotel Statler, St. Louis, Mo., on Monday, Tuesday and Wednesday, April 26, 27 and 28. They will attend meetings of the American Zinc Institute and also hold special meetings of their own.

One of their features will be a visit to the new hot and cold strip mills and galvanizing department of the Granite City Steel Co.

American Society for Testing Materials

260 S. Broad St., Philadelphia, Pa.

Symposium on Wear of Metals

On Monday, April 5, a Symposium on Wear of Metals will be held at the Engineers Club, 1317 Spruce St., Philadelphia, Pa. Dr. G. H. Clamer, President and General Manager, The Ajax Metal Co., Philadelphia, Pa., was one of the committee which arranged the program.

Among the papers to be read are the following:

General Discussion and Considerations Involved in Wear Testing, Including the Classi-

fication of the Various Types of Wear, by H. W. GILLETT, Metallurgist, Battelle Memorial Institute, Columbus, Ohio.

Wear of Metals from the Railroad Viewpoint, by L. W. WALLACE, Director, Equipment Research Division, Association of American Railroads, Chicago, Ill.

Wear from the Automotive Viewpoint, by W. E. JOMINY, Metallurgical Dept., Research Laboratories Section, General Motors Corp., Detroit, Mich.

Wear from the Power Equipment Viewpoint, by N. L. MOCHEL, Metallurgical Engineer, Westinghouse Elec. & Mfg. Co., Philadelphia, Pa.

International Association for Testing Materials

28 VICTORIA ST., LONDON, S. W. 1, ENGLAND

An International Congress of the International Association for Testing Materials, will be held in London, England, April 19-24th.

Among the subjects to be discussed are Metallography; Behavior of Metals (Mechanical and Chemical) as Dependent upon Temperature, Particularly High Temperature; Light Metals and their Alloys.

Porcelain Enamel Institute

612 N. MICHIGAN AVE., CHICAGO, ILL.

The first annual Forum of the Porcelain Enamel Institute will be held May 5, 6 and 7, at the University of Illinois, Urbana, Ill.

According to F. E. HODEK, JR., of the GENERAL PORCELAIN ENAMELING & MFG. CO., vice-president of the Institute, the speakers at the Forum will be outstanding men in the industry, and will present their papers from a practical viewpoint. Each paper will be followed by a Round Table Discussion on its subject.

National Battery Manufacturers Association

7 E. 44TH ST., NEW YORK

The National Battery Manufacturers Association will hold its 1937 spring convention at the Shoreham Hotel, Washington, D. C., May 13 and 14.

Personals

David Blanchard

The MAGNUS CHEMICAL CO., INC., Garwood, New Jersey, manufacturers of cleaning materials, industrial soaps, sulfonated oils, emulsifying agents and metal working lubricants, announces the appointment of DAVID BLANCHARD as Vice-President in Charge of Sales.

Mr. Blanchard has been Vice-President of the Company for the past fourteen years, in charge of the Portland, Maine office, where he made an enviable sales record. In fact, since 1930, Mr. Blanchard has led the sales force now numbering over sixty representatives. He was an officer in the Aviation Section of the United States Army during the World War.

David Blanchard

Charles F. Rohleder

CHARLES F. ROHLEDER has been appointed Chief Chemist of MAAS AND WALDSTEIN CO., Newark, N. J., makers of industrial finishes, according to an announcement issued by GUSTAVE KLINKENSTEIN, Vice-President and General Manager of that company. MR. ROHLEDER, was graduated from Cooper Union, New York, in 1926, with the degree of B.S. in Chemistry, and has spent all of his professional life in the industrial finishing field. His experience includes research, production control, and supervision of production. He is a native of New York City and is living at present at Belleville, New Jersey.

Charles F. Rohleder

Maynard J. Creighton

MAYNARD J. CREIGHTON, general manager of the Zapon Division of the Atlas Powder Company at Stamford, Conn., was elected to the Board of Directors of the Atlas Powder Company at the recent annual meeting.

Maynard J. Creighton

Mr. Creighton joined the Atlas Powder Company in 1915, the same year in which he was graduated from the University of Maine. After general experience in various plants at the Perryville Ammonium Nitrate operations, he was transferred to the Wilmington office of the company in 1919 to take charge of the Research Division.

In 1924 he became associated with the Zapon Company and became general manager of the division in 1935. In this capacity he has charge of all cellulose products manufacture and all sales for the company, including industrial finishes and coated fabrics. He also is in charge of the Zapon Brevolite Division with plant and offices at North Chicago, Ill.

At the annual stockholders' meeting of FARREL-BIRMINGHAM COMPANY, INC., held at the company's main office at Ansonia, Connecticut, on February 18, 1937, NELSON W. PICKERING was re-elected president. The following officers were also re-elected: FRANKLIN FARREL, JR., Chairman of Board of Directors; CARL HITCHCOCK, Vice-President; ARMIN G. KESSLER, Vice-President; FREDERICK M. DREW, JR., Treasurer; LAURIE K. BLACKMAN, Assistant Treasurer; GEORGE C. BRYANT, Secretary; WILLIAM B. MARVIN, Assistant Secretary. The entire board of directors was also re-elected with the addition of FRANKLIN FARREL III, the fourth generation of the Farrel family in direct descent from the founder to be actively associated with the company.

J. A. DWYER, manager of the Philadelphia branch of CRANE CO., becomes district manager of all Crane branches in the Eastern territory, including all of the New England states, in addition to metropolitan New York, Eastern Pennsylvania, New Jersey, Maryland, and the District of Columbia. A total of eighteen Crane establishments thus

come under the jurisdiction of Mr. Dwyer, whose headquarters will be at the company's New York branch. H. S. Officer, manager of the Newark branch, succeeds Mr. Dwyer at Philadelphia, and J. H. Geiss moves from Hempstead, Long Island, to succeed Mr. Officer as manager at Newark.

The James F. Lincoln Arc Welding Foundation, P. O. Box 5728, Cleveland, O., sponsor of the $200,000 arc welding prize contest, announces the appointment, as assistant secretary, of Edmond C. Powers who has been engaged for three years in technical writing for The Lincoln Electric Company, Cleveland, Ohio.

Frank Day has been appointed to the technical staff of Battelle Memorial Institute, Columbus, Ohio. Mr. Day is a graduate in Chemistry of Ohio State University. He has been assigned to a project in Chemical Engineering.

E. J. Ramaley has been appointed to the technical staff of Battelle Memorial Institute, Columbus, Ohio. Mr. Ramaley comes from the University of Colorado where he received the degree of M.Sc. in electrical engineering. He has been assigned to a research project dealing with the magnetic properties of alloys.

Howard L. Womochel has been appointed to the technical staff of Battelle Memorial Institute, Columbus, Ohio. Mr. Womochel is a graduate in Metallurgy of the University of Wisconsin and was formerly connected with the Burgess Parr Company. He has been assigned to the Metallurgical Division at Battelle.

Roy W. Johnson was elected vice-president at a recent meeting of the Board of Directors of the Atlantic Screw Works, Inc., Hartford, Conn. This position has been open since the death of A. W. Bowman, former vice-president. Samuel M. Monks, assistant secretary was elected secretary of the company, which position was left vacant by the death of Morton F. Miner.

Fred N. Mizer, first vice-president, Bishop & Babcock Mfg. Co., Cleveland, Ohio, has been appointed president and general manager, succeeding the late A. G. Bean. Before his affiliation with the Bishop & Babcock company in 1925, Mr. Mizer was factory manager of the General Industries Corp., Elyria, Ohio.

A. J. Heysel, New York state representative of the E. J. Woodison Co., Detroit, Mich., has returned from business in Italy, and is again covering the trade in New York state for the company.

B. B. Morton of the International Nickel Co., Inc., 67 Wall St., N. Y., spoke on "*Nickel Bearing Alloys for Refinery Service*" at the Eighth Annual Meeting of the Superintendents of the Continental Oil Co., Ponca City, Okla., March 10th.

Frank J. Enright has joined the A. F. Holden Company, New Haven, Conn., manufacturers and developers of heat treating baths, as director of sales and advertising. Mr. Enright has resigned as advertising manager of "Metal Progress" and the American Society for Metals with whom he has been associated for the past six years.

F. L. LaQue of the International Nickel Co., 67 Wall St., N. Y., addressed the New Jersey Chapter and the Detroit Chapter of the American Society for Metals at their meetings in Newark, N. J. and Detroit, Mich., on *The Properties and Applications of Nickel and Its Alloys*. The New Jersey meeting was held on March 12 and the Detroit meeting on March 15.

R. J. Southwell has been appointed Sales Manager of Andrew C. Campbell Division of American Chain & Cable Co., Inc., manufacturers of Campbell Abrasive Cutting Machines, Campbell Nibbling Machines and Special Machinery, with headquarters at Bridgeport, Conn.

Dr. Ing. Paul Schwarzkopf of Reutte, Austria, well known metallurgist, has accepted Presidency of the American Cutting Alloys, Inc., 500-5th Ave., New York City, it was announced by Pierce T. Wetter, Vice-President. This completes the reorganization of the Company. It now has a Mid-Western Office in Detroit, with J. M. Highducheck as Western Manager. The Eastern Office is located at 500-5th Avenue, with George B. Knaepper.

R. J. (Rudy) Hazucha, who is well known to the metal finishing industry through his activities in the American Electro-Platers' Society and the International Fellowship Club will participate in the A.B.C. Bowling Tournament, being held in New York. We look forward to seeing him at the head of the list when the tournament ends.

Obituaries

Horace Francis Carpenter

Horace F. Carpenter, for more than sixty years actively identified with the manufacturing jewelry industry of Providence, R. I., as a gold and silver refiner, died Sunday, February 28 in his home at 1766 Broad Street, in the Edgewood section of that city, in his 95th year. He was a charter member, and for nearly twenty years treasurer, of the Providence Jewelers' Club and its successor, the New England Manufacturing Jewelers' and Silversmiths' Association; discoverer and developer of the method of salvaging valuable by-products from photographic waste, and a process for obtaining chemically pure gold.

At his funeral there were a number of the oldest members of the jewelry industry of Providence and the Attleboros, including representatives of the Association which he served so long and faithfully.—W. H. M.

Frederick A. Croselmire

Frederick A. Croselmire, a member of the firm of Baker & Co. Inc., Newark, N. J., died at his home in East Orange, N. J., March 19th.

Mr. Croselmire entered the precious metal refining business in Newark with his father, the late Charles F. Croselmire. He then became a partner in the firm of Croselmire and Ackor and thereafter joined the Roessler & Hasslacher Chemical Co. with whom he was associated for twenty-four years. He had been with Baker & Co. for seven years.

Charles F. L'Hommedieu

As we go to press word comes of the death of Charles F. L'Hommedieu, 93 years old, founder of the plating and polishing equipment and supply concern bearing his name. He died March 19 at his home in Los Angeles.

An extended biography will appear in our May issue.

E. E. Anderson

Edward Enoch Anderson, aged 55, owner of the Capital City Plating Works, Sacramento, Calif., died March 12 after a year's illness. He had been a resident of Sacramento for thirty years.

Mr. Anderson leaves a widow, Mrs. Ethel M. Anderson and a daughter Ruth Ester Anderson.

Eugene C. Rogers

Eugene C. Rogers, a son of the late Gilbert Rogers who was the founder of C. Rogers & Bros., Meriden, Conn., (now part of the International Silver Co.) died of a heart attack at his home in New York, March 22nd.

William L. Churchill

William L. Churchill, an inventor, mechanical engineer and industrial economist, died of pneumonia recently at his home in Ogden Avenue, White Plains, N. Y. He was 66 years old and served many manufacturing corporations in perfecting efficiency systems. Mr. Churchill was author of a book "Pricing for Profit." Surviving are his widow, and four children, Ruth E., John K., H. Lloyd and Ralph O. Churchill, all of White Plains.

Mr. Churchill was the author of several articles published in Metal Industry.

J. Randolph Marshall

J. Randolph Marshall, president of the Farrell Silver Plating Co., 424 Sixth Ave., New York, died at his home recently, of pneumonia after a week's illness, at the age of 45. His widow, Catherine; a son, a daughter, a brother, Walton H. Marshall of New York, who is vice-president of Pease and Elliman, and a sister, E. Marshall of Orange, Va., survive. Mr. Marshall, a native of Orange, where he received his early education, was a great-grandson of Chief Justice John Marshall. He was a graduate of the University of Virginia.

Charles E. Larter

Charles E. Larter, proprietor of the Lynn Nickel Plating Co., 493 Union St., Lynn, Mass., died recently at his home on 10 Timson St., following a lingering illness.

George Cortlidge

George Cortlidge, foreman plater, Hart Mfg. Co., Hartford, Conn., died March 21.

Andrew J. Peoples

Andrew J. Peoples, manager of the Detroit plant of the American Brass Co., died on Feb. 12, aged 65 years. Mr. Peoples was born at Novi, Mich., and at the age of 20 went to Detroit as a telegrapher. Later he entered the employ of the old Detroit Copper & Brass Rolling Mills and rose to executive positions in that company until it was merged with American Brass twenty-five years ago.

Fred B. Erb

Fred B. Erb, president and general manager of the Eaton-Erb Foundry Co., at Vassar, Mich., died of a heart attack on Friday, February 19, on board the S. S. New York, two hours after the ship sailed on a 19-day cruise to the West Indies. With Mr. Erb was his wife and his brother-in-law, Arthur L. Lawson.

Mr. Erb was born in Royal Oak, Mich., a Detroit suburb, on April 3, 1887. After graduating from high school in 1904, he attended the University of Michigan, receiving a degree in mechanical engineering in 1908. Then he entered the foundry business and later became well known through his association with the American Foundryman's Association of which he was a former president.—F. J. H.

Industrial and Financial News

Corporation Earnings

NET PROFIT UNLESS FOLLOWED BY (L) WHICH IS LOSS

	1936	1935
Advance Aluminum Castings Corp.	$86,316	$71,250
Aluminum Co. of America	20,866,936	9,571,206
Aluminum Goods Mfg. Co.	1,377,245	924,126
Aluminum Industries Inc.	64,697	72,675
American Hardware Corp.	815,715	101,130
Anaconda Copper Mining Co.	15,881,830	11,180,087
Anaconda Wire & Cable Co.	4,759,153	2,942,125
Bridgeport Brass Co.	1,076,201	726,618
Doehler Die Casting Co.	894,139	623,818
Ferro Enamel Corp.	427,260	239,748
General Bronze Corp.	325,087 (L)	80,336
General Cable Corp.	1,654,178	407,839
General Electric Co.	43,947,000	27,843,772
General Metals Corp.	289,610	174,211
Gorham Mfg. Co.	420,105	160,428
Grand Rapids Brass Co. (5 months to Jan. 31st.)	11,829	51,081 (L)
International Nickel Co.	36,865,526	26,086,527
Manning, Bowman Co.	40,021	21,500
National Enameling Co.	343,230	312,894
Revere Copper & Brass, Inc.	2,023,807	425,655
Reynolds Metals Co.	2,172,034	1,419,267
Scovill Mfg. Co.	3,151,180	1,103,127
Westinghouse Electric & Mfg. Co.	15,099,291	11,983,380
Wolverine Tube Co.	460,874	130,779
Yale and Towne Mfg. Co.	1,211,119	477,665

Metal Developments

Wage raises have been the outstanding industrial feature for several months. Increases have been put into effect by CHASE BRASS & COPPER CO., Waterbury, Conn.; ALUMINUM CO. OF AMERICA, New Kensington, Pa.; SCOVILL MFG. CO., Waterbury, Conn.; AMERICAN BRASS CO., Waterbury, Conn., Buffalo, N. Y., and Detroit, Mich., among, of course, a great many others, all too numerous to list here.

According to the TWENTIETH CENTURY FUND, New York, typical tax systems now existing in the United States impose, for $5,000 incomes, consistently heavier tax burdens on merchants (manufacturers and other business men) than on salaried workers, even where business taxes are entirely shifted to the consumer. Two cases in Illinois are mentioned, in which merchants' tax burdens exceeded 50% of the income which they would have received if taxes had not existed. The highest for any salaried worker in Illinois is 20.5%.

We know many, many small manufacturers, including job platers and foundrymen who will all testify to the truth of the above.

THE AIR HYGIENE FOUNDATION OF AMERICA, 4400 Fifth Ave., Pittsburgh, Pa., has recommended a six-point program for protecting the health of industrial workers and a definite plan of medical research designed to help curb industrial disease. This plan is available in the Foundation's report on *"Silicosis and Allied Disorders."*

WORKS PROGRESS ADMINISTRATION, Washington, D. C., reports that W.P.A. purchases of metal products up to February 1st, 1937, totalled $71,870,690, which were used on more than 50,000 construction projects operated in the 48 states. Cast iron pipe and fittings led the list with $21,605,663; non-ferrous metals totalled $1,692,601. One of the striking jobs was the installation of a Monel metal roof on the New York Public Library covering 108,000 sq. ft.

Supreme Court Refuses to Review Chromium Patent Suit

The Supreme Court of the United States, on March 15, 1937, denied the petition for a Writ of Certiorari to review the decision of the Circuit Court of Appeals for the Second Circuit in the suit of United Chromium, Incorporated vs. General Motors Corp., New Departure Manufacturing Company and the Bassick Co. This decision was in favor of General Motors, New Departure and the Bassick Co.

We understand that the refusal of the Supreme Court to grant the petition for a Writ of Certiorari and to pass on the merits of the case means that the matter of the validity of the Fink Patent will not be passed on by the Supreme Court unless some other Circuit Court of Appeals reaches a different decision.

We are informed that further steps for the protection of its rights under the patents owned by it are being considered by counsel for United Chromium, Incorporated.

Quarterly Dividends to Workers and Stockholders Alike

A new plan of sharing profits with their employees has been adopted by ROXALIN FLEXIBLE LACQUER COMPANY, INC., Elizabeth, N. J., manufacturers of lacquer and synthetic finishes. One of the features of this plan is the presentation of 5,000 shares of new Class "B" stock to seven key men in recognition of their services to the company. These men are A. MIESEM, Treasurer and Sales Director; W. HANLEY, Member of the Board; J. L. ARNOLD, Director of Promotion; M. A. DORIAN, Chief Chemist; S. S. BERGER, Comptroller; R. V. K[illegible], Sec-

retary and Plant Manager; R. SEDGWICK, Plant Superintendent.

Profits will be divided quarterly as follows:

1. Dividends to holders of common stock.
2. Dividends to holders of Class B stock.
3. Wage dividends to all other workers.

The company is confident that its greatly increased business will give better returns both to stockholders and employees than the former plan (which was in effect for ten years) of paying its employees an annual bonus, based on a percentage of the net profits and divided in accordance with length of service and rate of pay.

Roxalin has recently purchased an additional plot, 200′ x 216′ adjacent to its plant, with the intention of lengthening its present railroad siding and providing room for further expansion.

Verified Business Items

STANDARD SILICATE DIV., DIAMOND ALKALI CO., Koppers Bldg., Pittsburgh, Pa., announce erection of a new detergent plant at Jersey City, N. J. The growth in the use of silicated alkalies is responsible for this expansion. The company manufactures standard silicates and alkali cleaners.

LONERGAN MFG. CO., Michigan City, Ind., manufacturers of oil and water heaters, parts, etc., have acquired former plant of KELSEY-HAYES WHEEL CO., Albion, Mich., for expansion of capacity to increase their manufacturing facilities. Departments: tool room, brazing, grinding, polishing and buffing.

TROJAN PRODUCTS & MFG. CO. INC., Chicago, Ill., manufacturers of industrial cleaning compounds will move into new quarters at 3130-3136 S. Wabash Ave., Chicago, about April 30th. A three-story building will give them five times more space than they occupy at present.

THE SPECIAL CHEMICALS CORP., 30 Irving Place, New York, N. Y. announces the engagement of NAT FLEET as Technical Advisor. MR. FLEET is a member of the American Electro-Platers Society, New York branch and for the past 25 years has been active in the electroplating industry, particularly on industrial finishes and precious metals. THE SPECIAL CHEMICALS CORP. has taken additional space at the same address for the enlargement of their laboratory facilities and executive offices.

A written agreement was entered into Feb. 18 between MONDAINE PRODUCTS CORP., 20 W. 30th St., New York City, and WILLIAM J. LOHN, INC., 203 Centre St., New York City, pursuant to which all of the assets of the MONDAINE PRODUCTS CORP. including the good will, trade name, trade marks, patents, licenses, plant, equipment and tangible personal property, located at 20 W. 20th Street, New York and the color plating plant located at 35 W. 19th St., New Rork, but not including the cash, bank balance and receivables, for a minimum price of $22,000.

REGENT METAL PRODUCTS INC., 108 Worcester St., New York, have been organized to do a manufacturing and job plating business. The firm will specialize in vanity compacts, lipstick holders and containers for cosmetics. Occupying the whole 5th floor of this building, their plant is equipped for polishing, plating and finishing in various colors and metals including chromium, cadmium, nickel, copper, gold and silver. They will also do tumbling and enameling. The company is staffed by three former employees of MAJESTIC METAL SPECIALTIES CO., New York.

BRACKETT'S ANTIQUES, 40 E. California St., Pasadena, Calif., expect to go into silversmithing and electroplating.

WHITE MOTOR CO., Cleveland, Ohio, are launching a $2,000,000 plan of expansion to their plant for building heavy duty bus bodies. They will purchase new machinery, precision tools, heat treating and testing equipment.

M. L. SNYDER & SON, 116 N. 3rd Street, Philadelphia, Pa., have moved their plant and general offices into a new factory at 116 N. 3rd St., Philadelphia. In addition they are moving the factory which they now have in St. Louis into the Philadelphia plant. This company manufactures a variety of rubber items: oiled clothing and fire equipment; rubber aprons, rubber gloves, rubber boots, rubber suits, hard rubber acid buckets, dippers and hose, etc. They were established in 1878 and have branches in St. Louis, Seattle, Los Angeles and San Francisco, with separate manufacturing units in St. Louis and Seattle.

L. M. DEMAREST AND ASSOCIATES, 230 Park Ave., New York, announce that they have clients who are interested in purchasing outright, manufacturing concerns, or arranging for financing, manufacturing, etc. of the following products: resistance wire; electrical household specialties; chemical products; stamped metal products; electrical fittings; manufacturing products for the can making industry; automotive and aviation products.

KOPPERNITE PRODUCTS CO., Richmond, Virginia, are contemplating entering the plating field, having been indirectly connected with this line of work for a number of years.

GENERAL RIVET CO., 1311 W. 80th St., Cleveland, Ohio, have been organized to manufacture rivets of all kinds from all metals. The organization is composed of men who have been experienced in this line for many years. They specialize in tubular and split rivets. They are buyers of copper and brass wire, aluminum wire, etc. Departments: japanning, enameling, copper plating, nickel plating and Parkerizing. W. H. SCHWAB is general manager.

WINKLER MFG. CORP., Lebanon, Ind., recently organized by CARL J. WINKLER and associates, have acquired plant and assets of INDESTRUCTIBLE WHEEL CORP., Lebanon, manufacturer of disk wheels. Plant will be expanded, with new department for production of automobile parts and household specialties. CARL J. WINKLER is president and treasurer, and H. E. WINKLER, vice-president and chief engineer. Departments: tool room, stamping, grinding, lacquering and Japanning.

PANGBORN CORPORATION, Hagerstown, Maryland, blast cleaning and dust collecting equipment, are making extensive additions to their plant. This building expansion program is in line with the activity of the company and involves an expenditure for building construction and new equipment of approximately $80,000.

MCALEER MFG. CO., 2431 Scotten Ave., Detroit, Mich., have appointed CROWN RHEOSTAT & SUPPLY CO., 1908 Maypole Ave., Chicago, Ill., exclusive distributor of their compounds for buffing all metals and finishes. The Crown company will carry a full stock of all types.

H. KRAMER & COMPANY, 21st and Loomis Sts., Chicago, manufacturers of brass and bronze ingots, announce the establishment of a sales office at 828 North Broadway, Milwaukee, Wisconsin. The company's representative is DON E. STEPHENS.

THE BLACK & DECKER MFG. CO. announce the appointment of JOHN M. SCHREINER as manager of their Detroit Branch succeeding the late GEORGE W. STOIBER. MR. SCHREINER has been active in the Detroit area for the past twelve years. W. J. FENWICK, who for the past several years has been co-manager of the Cleveland territory, has been appointed Manager of all activities in that Branch. G. H. TRESLER has been appointed Supervisor of the Detroit and Cleveland territories and will cooperate with MR. SCHREINER and MR. FENWICK in the promotion of sales in these areas.

ULTREX CHEMICAL PRODUCTS, INC., are now associated with the ENEQUIST CHEMICAL CO., INC., 255 Freeman St., Brooklyn, N. Y., in that Enequist officers, as individuals, have made a very substantial investment. The ULTREX offices have been moved to the above address. HAROLD DE TREMBICKI is president of the re-organized company; JOHN ENEQUIST, vice-president and LOUIS A. CATES, treasurer. ULTREX produces special cleaners that are distributed all over the country. The factory which remains at 14-27 Broadway, L. I. City, has been enlarged and continues under the direction of MR. DE TREMBICKI, who has spent the greater part of his life in this business.

EXCEL CABINET CO., INC., held their annual meeting recently and the stockholders elected the following directors: CONRAD A. JOHNSON, FRED J. FLEMMING, EMIL WIDMARK, HUGO LINDGREN and LARS OLSON. The directors elected the following officers: president and treasurer, CONRAD A. JOHNSON; vice-president, FRED J. FLEMMING; secretary, HUGO LINDGREN.

ELECTRIC SOLDERING IRON CO. and HEALTH RAY LAMP CORP., New York, both owned by LEONARD YOUNG, have been moved to Deep River, Conn., where manufacturing will be carried on in the former plant of PRATT, READ & CO.

The Edgewater, N. J., plant of the ALUMINUM CO. OF AMERICA, will be enlarged. Work will be provided for about 500 persons when the improvements are completed. The plant now employs about 2,000 men, which is higher than during the peak days of 1929.

LOUIS A. THIESEN of the METAL PRODUCTS CORP., has purchased the two-story factory building occupying a half block fronting on W. 19th St. and Grand and Chestnut Sts., Weehawken, N. J. The company is undergoing an expansion program, which when completed will triple the space now occupied.

REVERE BRASS AND COPPER, INC., 247 Park Ave., New York, have begun the expansion of their plant in New Bedford, Mass. The addition will be 258 ft. long, 100 ft. wide and 24 ft. high, one story, to increase the capacity of the present strip mill.

News from Field Correspondents

Waterbury, Conn.

March 26, 1937.

A pay increase amounting to 5 cents an hour for hourly and piece workers was announced by the AMERICAN BRASS CO. March 1, followed shortly after by similar increases by the SCOVILL MFG. CO. and the CHASE BRASS & COPPER CO. This is the third raise of this amount granted in the last six months.

A similar raise was given by the WATERBURY TOOL CO., which follows a 10 per cent increase two months ago.

The WATERBURY BUCKLE CO. gave an increase of 5 cents an hour to hourly workers and an increase of 7 per cent in piece work rates.

For the fourth consecutive month employment soared to higher levels than since the World War. The figure for February was 36,994, an increase of 191 over January. In the eight largest factories the increase was 271. Bank clearings for February were $6,775,500, a slight decrease from January but an increase of $1,600,000 over the same month last year. Freight tonnage received in the city during the month amounted to over 57,000 tons, an increase of 1,600 tons over January. Freight forwarded amounted to 14,000, an increase of 170 tons.

More than 2,000, almost the entire personnel of the WATERBURY CLOCK CO., struck for a 10 per cent pay raise and time and one-half for more than 40 hours work a week. The pay raise was granted almost immediately and the employees immediately went back to work. The management, after consideration. refused to grant time and one-half but the workers did not press for it.

About 700 workers of the LUX CLOCK CO. went out on a strike Feb. 6 after being granted a 5 per cent raise. They wanted a 10 per cent raise. However, the following day most of them returned. It is learned that since the depression the wages were cut twice by 10 per cent and raised three times, once by 10 per cent and twice by 5 per cent.'

Workers of the WATERBURY BATTERY CO. struck for 10 cents more an hour but went back to work after being granted an increase of 7½ cents.

Employees of the BRISTOL CO. demanded an increase of 10 per cent and the company promptly granted it and also announced annual vacations of one week with pay would be given, although this was not requested. There was no walk-out.

The E. J. MANVILLE MACHINE CO. voluntarily granted an increase of five cents an hour.

Organizers of the BRASS WORKERS UNION, a C. I. O. affiliate, are daily touring the local plants, stopping at the gates at the noon hour and urging the workers, by means of a sound car, to join the union.—W. R. B.

Connecticut Notes

March 26, 1937.

NEW BRITAIN—LANDERS, FRARY & CLARK increased wages 5 per cent March 1, announced it would pay time and one-half for over 45 hours a week and a bonus of 5 per cent on earnings for the past three months.

WALTER H. HART has retired as vice-president of the STANLEY WORKS. The directors last month reelected all other officers including the President, C. F. BENNETT. The stockholders added ERNEST W. CHRIST, LOUIS W. YOUNG, THOMAS W. RUSSELL, and MAURICE H. PEASE to the board of directors. The company will pay a dividend of 40 cents a share on March 31. Last year the quarterly dividends were 25c each.

NORTH & JUDD CO. announced a 5 per cent raise in wages on March 8, and time and one-half for all over 45 hours a week.

THE UNION MFG. CO. has added three directors to the board, C. S. MUELLER, WILLIAM H. JUDD and MAXWELL S. PORTER.

BRISTOL—THE E. INGRAHAM CO. plans erection of a single-story, monitor type building, a four story factory building and two floors to the present three-story office building.

BRIDGEPORT—THE BRIDGEPORT BRASS CO. directors have authorized a $3,000,000 plant addition, including a new casting shop, new rolling mill, several other buildings and new equipment. A new issue of common stock will be floated to finance the program. The company will pay a quarterly dividend of 15 cents a share on March 31. The previous quarter, a 10 cent regular and a 50 cent extra were paid.

MERIDEN—THE INTERNATIONAL SILVER CO. plans two large additions, a story-addition, 100 by 400 feet to the metal stamping division, and the other a four-story addition to its plating and finishing department. The cost is estimated at $100,000.

THOMASTON—HARRY C. CLOW, production manager of the EAGLE LOCK CO. and recently elected secretary, has been appointed purchasing agent. ROLLIN W. PLUMB, who has been in the Philadelphia office, has been appointed production manager.

Employees of the company received another five per cent increase, after a threatened strike last month. Two months ago after a strike, they received a 10 per cent raise.

THE PLUME & ATWOOD CO. is erecting a new office building.

NAUGATUCK—Employees of the RISDON MFG. CO. struck for an increase of 10 cents an hour March 9. The company offered an increase of five cents which was turned down, and later an increase of 7½ cents which was first turned down but later accepted. The company has announced that all safety pins of the concern will hereafter be manufactured in the former SMITH & GRIGGS plant in Waterbury. Machinery has been moved there from the CONSOLIDATED PIN CO. of Bloomfield, N. J. which has been purchased recently.—W. R. B.

Providence, R. I.

March 26, 1937.

The most outstanding increase in wages for the month of February in any of the industrial groups in Rhode Island, as indicated by the payroll withdrawals from banks in this State, was in the non-ferrous metal trades according to a report released a few days ago by the Brown Bureau of Business Research. The total withdrawals amounted in these trades to $334,689 which was 77 per cent greater than during the corresponding month a year ago, although an advance of only 9.2 per cent over the preceding month and this in view of the shorter month.

The withdrawals by the manufacturing jewelry and silverware industries during February were 9.1 per cent greater than in February of last year and were up 8.9 per cent from the preceding month, which is recognized as one of the dullest months of the year in these industries. The total payroll withdrawals of these industries amounted to $943,067.

THE GORHAM MANUFACTURING COMPANY has been awarded the contract for the bronze work, grills, etc. for a $50,000 mausoleum in Swan Point Cemetery.

James Scacciotti of 24 Lowell Avenue is the owner of The Progress Jewelry Manufacturing Co., 204 Chestnut Street.

The Clayton Co., manufacturing jewelers at 226 Eddy Street, is owned by Louis E. Perreault of West Kingston, R. I.; John Moretti and Joseph Pirraglia both of Cranston.

At the regular monthly meeting of the Metal Findings Manufacturers Association held at the Narragansett Hotel on March 3, present conditions and prospects were discussed and several trade problems considered. A luncheon was served in one of the private dining rooms preceding the business meeting.

Col. Harold R. Barker, treasurer and manager of the Fulford Manufacturing Company, has been promoted to Brigadier General in command of the 68th Field Artillery Brigade, United States National Guard.—W. H. M.

Utica, N. Y.

March 26, 1937.

Factories manufacturing metal articles in the Mohawk Valley are reporting increased business. The Industrial Association of Utica reported that the metal trades registered a four per cent employment advance in February over January and a 6.8 per cent rise in hours worked. Employment used up 14.1 per cent over February of last year.

A wage increase of four cents an hour for approximately 1,300 employees of the General Cable Corporation in Rome, N. Y. was announced early in March by the management. In addition the workers are to receive time and one half for overtime. An eight hour day, 40 hour week program was announced. An average of about 60 persons a month have been added to the payroll since last June. The pay increase was the second in recent weeks for Dec. 1, 1936 pay of employees was raised five per cent.

Herbert Powell, head of the Powell Muffler Company, Utica, N. Y., reported that his factory which employs about 100 men is closing the first quarter of the year with business better than it has been for some time.

Irving L. Jones, secretary-treasurer, International Heater Company, reports that opportunity for further employment in local factories and mills is opening up and that skilled workers particularly are needed.

Early in March the Labor Relations Board ordered Remington Rand Inc. to take back 4,000 employees the board said had lost jobs in a strike started last May in six of the company's plants including those in Ilion and Syracuse.—E. K. B.

Newark, N. J.

The American Chain and Cable Co., 462 Riverside Avenue, Newark, which has been closed for nearly a year, resumed operations recently. About 100 former employees have been given work. New machinery has been installed and equipment brought from the company's plant at Wilkes-Barre, Pa.

The National Lead Co., plant at Sayreville, N. J. titanium division, will double its new $3,000,000 plant during the latter part of this year, officials of the New York

office have announced. The company manufactures titanium oxide pigments. The lead company owns a sixty-five acre tract at Sayreville.

A $50,000 assessment on personal property of W. C. Horb Brothers & Co., novelty manufacturers, of Newark, has been sustained by the State Board of Taxation; reduced from $75,000.—C. A. L.

Trenton, N. J.

Ferdinand W. Roebling 3d, son of the late Ferdinand W. Roebling, Jr., has been elected second vice president of the *John A. Roebling Sons' Co.*, of this city. Other changes voted at the annual meeting of the directorate includes Charles R. Tyson as treasurer; Harvey Cooley as secretary to succeed Austin C. Cooley, and Walter M. Wells as assistant treasurer and assistant secretary. William A. Anderson continues as president of the company and Joseph M. Roebling as first vice president.

Following concerns have been incorporated here: *Meadows Metal Corp.*, Kearny, $15,000; *Photo Chemicals, Inc.*, Jersey City, 500 shares, no par; *Miller Mfg. Co.*, Camden, chemicals, $125,000; *Freshman Silber, Inc.*, jewelry, Atlantic City, 100 shares, no par; *Edison Co., Inc.*, manufacture electrical appliances, Paterson, $100,000.—C. A. L.

Detroit, Mich.

March 26, 1937.

Although strikes and rumors of strike continue to pester this area, there continues a general upward trend in business. If all the labor problems could be wiped out over night, production in non-ferrous metals would surge ahead at a rate that would astonish the world.

As a part of a broad program for the town of Ways, Ga., a rural community 18 miles from Savannah, the Ford Motor Co., here has announced that an automobile parts plant will shortly be erected there and that plans for the buildings are now being drafted. It is expected, it is stated, to use only workmen living in that area.

Fire swept the two-story factory building of the Wolverine Die Castings Co. in Grand Rapids, on Feb. 13, causing damage estimated about $50,000. The flames, it is stated, started from a leak in a connection to an oil tank and rapidly spread.

Charles E. Attwood, president of the Attwood Brass Works, at Grand Rapids, announced on March 6, the settlement of a strike which began in his plant the previous Monday. He did not reveal the terms, but said they were satisfactory to both sides.

More than 1,000 employees of the Detroit branch of the Aluminum Co. of America, have shared in a wage increase amounting to 10 per cent, for all persons on an hourly basis as of March 1, it is announced.

Workers numbering upwards of 1,000 at the Detroit branch of the American Brass Co., 174 Clark Avenue, South, have been granted a wage increase of approximately 5 cents an hour on hourly rates and 7 per cent on piece work, effective as of Feb. 28, according to officials of the organization. This raise is the third by the American Brass Co. in six months.—F. J. H.

Metal Market Review

MARCH 26, 1937.

COPPER, along with the other metals, resumed its gyrations which pointed consistently upward. The month was to say the least, exciting. American copper which closed February at 15 was under constant tension from London where the quotations remained above American prices. Finally on March 8th the spread became so great that domestic producers were forced to raise their price by the largest single increase since the rise began, 1¼c, to 16¼c per pound. The export market immediately followed by climbing steadily to as high as 17.60 when it reacted. The price at the time of this writing is still 16.25 for domestic; 17.15 CIF foreign ports.

World's stocks of refined copper decreased 6,024 tons during February. American stocks decreased 4,120 tons and foreign stocks 1,904 tons. American sales, week by week were 11,056, 19,519, 8,932 and 6,847 tons, making a total of 46,354 tons.

For a time speculative investment abroad was dampened because of the slow but steady increase in the production of blister, which will reach the market within the next few months. At the present time, however, the American market is quite firm with prospects tending toward steadiness rather than downward.

ZINC climbed steadily and steeply. After rounding out February at 6.80c per pound Prime Western, E. St. Louis, the demand continued active and the spot market was decidedly tight. On March 2nd, the price rose to 7c, on March 8th to 7½c where it remained until the close of the month. Sales were 6,000 tons; 9,000 tons; 8,000 tons and 3,300 tons, a total of 26,300 tons. The market is still in a tight position with further rises not improbable.

CADMIUM which has long been among the more expensive base metals, also joined the party with a jump from 75c to a range of 90c to $1.20 per pound for spot and forward shipment. Cause—activity in the zinc market of which cadmium is a by-product and the demands of the automobile manufacturers who are using cadmium for bearings.

TIN resumed its old position as a speculative leader. At the close of February it was in a decidedly strong position at 54.75c per lb. for Straits, and from then on its rise was steep continuing steadily, on some days increasing as much as 3c, until March 10th when it touched 66. After a momentary reaction it rose to 66.75, teetered back and forth unsteadily, dropped to 62 and is now selling at over 65. Part of the upward flight was induced by removal of the threat of labor difficulties in the steel industry when the steel makers came to terms with the CIO. American purchases of tin for tinplate started the boom in the London market. When this demand receded, the metal resumed its see-sawing activities, but late in the month news that was bullish arrived, pointing to a stronger demand for tin for munitions.

Quotas were unchanged at 100% during

the second quarter by the Tin Committee who stated that this would be sufficient to bring about a steady increase in the world's visible supply. At the present time, however, spot metal is far from plentiful.

LEAD had the most exciting experience during the month. Beginning at 6.85c per lb. FOB St. Louis, to which it had risen from 5.85, it continued to climb in several successive advances within the next two weeks to 7.60 St. Louis. During the third week, however, the fluctuations on the London Metal Exchange were followed and quotations dropped to 7.35 on March 16th, 7.10 on March 17th, then to 6.85 and 6.80 where it now rests. Although the long pull prospects for lead are the same as for other metals, probably upward, the immediate future is cloudy because of the speculative activities in London.

American sales, week by week, were 11,900 tons; 11,000 tons; 4,700 tons and 2,500 tons, making a total of 30,100 tons.

ALUMINUM "made history" its first move for many, many months—a rise in the base price to 20c per lb. as against the former 19c to 22c quotation. Demand for this metal is enormous and supplies not plentiful. Needless to say, the market will not be speculative as it is, in the United States at any rate, under control.

SILVER exhibited some activity, perhaps only in sympathy with other metals, as no other reason was discernible. Quotations rose from 44¾c per ounce to 45¾c during the middle of the month, and then reacted to 45c. At the present time there is no indication of any good reason for a move in either direction.

PLATINUM, spent the month in retirement, quietly, at $58.00 per ounce.

WROUGHT METAL distribution within the past month is indicated by a report of a Metropolitan distributor to the effect that March was 25% above February and 110% above March 1936.

SCRAP METALS, needless to say, had their troubles. In the case of copper they followed closely the movements of the export market and the drain on American supplies, due to the higher prices in London, was considerable. For the first two weeks all major scrap bids rose following the rise and speculation abroad. They reacted but the American smelters' intake continued large as dealers poured their stocks in to avoid being caught with heavy inventories in a steep decline. At the close of the month trends were mixed, refiners reducing their bids on two successive days and then advancing their bids on the third day, for copper. Lead continued weak.

On March 1, unfilled orders for brass and bronze ingots and billets on the books of the members of the Non-Ferrous Ingot Metal Institute amounted to a total of 30,286 net tons.

The combined deliveries of brass and bronze ingots and billets by the members of the Institute for the month of February, 1937, amounted to a total of 9,433 tons.

The Ferrous Ingot Metal Institute reports the average prices per pound received by its membership on Commercial Grades of six principal mixtures of Ingot Brass during the twenty-eight day period ending March 19.

80-10-10 (1½% Imp.)	18.588c
78% Metal	15.733c
81% Metal	15.880c
83% Metal	16.128c
85% Metal	16.409c
No. 1 Yellow Brass	12.572c

Average Prices for Metals

	March
COPPER c/lb. Duty 4c/lb.	
LAKE (del. Conn. Producers' Prices)	16.053
ELECTROLYTIC (del. Conn. Producers' Prices)	15.990
CASTING (f.o.b. ref.)	16.162
ZINC (f.o.b. E. St. Louis) c/lb. Duty 1¾ c/lb.	
Prime Western (for Brass Special add 0.05-.0.10)	7.377
TIN (f.o.b. N. Y.) c/lb. Duty Free, Straits	62.709
LEAD (f.o.b. St. L.) c/lb. Duty 2½ c/lb.	7.046
ALUMINUM c/lb. Duty 4 c/lb.	20.000
NICKEL c/lb. Duty 3 c/lb. Electrolytic 99.9%	35.000
ANTIMONY (Ch. 99%) c/lb. Duty 2c/lb.	16.92
SILVER c/oz. Troy, Duty Free	45.130
PLATINUM $/oz. Troy, Duty Free	56.50
GOLD—Official U. S. Treasury Price $/oz. Troy	35.000

Metal Prices, March 25, 1937

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

New Metals

COPPER: Lake, 16.375, Electrolytic, 16.25, Casting, 16.25.
ZINC: Prime Western, 7.50. Brass Special, 7.60.
TIN: Straits 66.00.
LEAD: 6.80. ALUMINUM, 20. ANTIMONY, 17.00.
NICKEL: Shot, 36. Elec., 35.

QUICKSILVER: Flasks, 75 lbs., $95. BISMUTH, $1.00.
CADMIUM, 90c to $1.20. SILVER, Troy oz., official price, N. Y., Mar. 26, 45c. GOLD: Oz. Troy, Official U. S. Treasury price, $35.00.
SCRAP GOLD, 6¾c. per pennyweight per karat, dealers' quotation.
PLATINUM, oz. Troy $58.00.

Duties: Copper, 4c. lb.; zinc, 1¾c. lb.; tin, free; lead, 2½c. lb.; aluminum, 4c. lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c. lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

Ingot Metals and Alloys

	Cents lb.	U. S. Import Duty	Tax*
No. 1 Yellow Brass	13.50	None	4c. lb.[1]
85-5-5-5	17.50	None	4c. lb.[1]
88-10-2	22.00	None	4c. lb.[1]
80-10-10	19.875	None	4c. lb.[1]
Manganese Bronze (60,000 t. s. min.)	17.00	None	4c. lb.[1]
Aluminum Bronze	22.00	None	4c. lb.[1]
Monel Metal Shot or Block	28	25% a. v.	None
Nickel Silver (12% Ni)	18.00	20% a. v.	4c. lb.[1]
Nickel Silver (15% Ni)	21.00	20% a. v.	4c. lb.[1]
No. 12 Aluminum	19-25	4c. lb.	None
Manganese Copper, Grade A (30%)	26-32	25% a. v.	3c. lb.[1]
Phosphor Copper, 10%	20-22	3c. lb.	4c. lb.[1]
Phosphor Copper, 15%	21-23	3c. lb.	4c. lb.[1]
Silicon Copper, 10%	25-37	45% a. v.	4c. lb.[1]
Phosphor Tin, no guarantee	70 80	None	None
Iridium Platinum, 5% (Nominal)	$62.00	None	None
Iridium Platinum, 10% (Nominal)	$66.00	None	None

*** Duty is under U. S. Tariff Act of 1930; tax under Section 60 (7) of Revenue Act of 1932.**
[1] On copper content. [2] On total weight. "a. v." means ad valorem.

Old Metals

Dealers' buying prices, wholesale quantities:	Cents. lb.	Duty	U. S. Import Tax
Heavy copper and wire, mixed	13½to13¾	Free	4c. per pound on copper content
Light copper	11½to11¾	Free	
Heavy yellow brass	8½to 8¾	Free	
Light brass	7¼to 7¾	Free	
No. 1 composition	11½to11¾	Free	
Composition turnings	11⅛to11½	Free	
Heavy soft lead	5⅝to 5¾	2⅛c. lb.	
Old zinc	4½to 4¾	1½c. lb.	
New zinc clips	6 to 6¼	1½c. lb.	
Aluminum clips (new, soft)	14½to15	4c. lb.	
Scrap aluminum, cast	12¼to12½	4c. lb.	
Aluminum borings—turnings	8 to 9	4c. lb.	None
No. 1 pewter	40 to 41	Free	
Electrotype	6½to 6¾	2⅛c. lb.*	
Nickel anodes	26 to 27	10%	
Nickel clips, new	28 to 29	10%	
Monel scrap	8½to 17	10% av.	

*** On lead content.**

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' price lists, effective since March 31, 1937. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 pounds; on nickel silver, from 1,000 to 2,000 pounds.

Copper Material

	Net base per lb.	Duty*
Sheet, hot rolled	24⅝c.	2½c. lb.
Bare wire, soft, less than carloads	21⅛c.	25% a. v.
Seamless tubing	25⅜c.	7c. lb.

*** Each of the above subject to import tax of 4c. lb. in addition to duty under Revenue Act of 1932.**

Nickel Silver

Net base prices per lb. (Duty 30% ad valorem.)

Sheet Metal		Wire and Rod	
10% Quality	31½c.	10% Quality	34⅛c.
15% Quality	33⅝c.	15% Quality	38½c.
18% Quality	34⅞c.	18% Quality	41¾c.

Brass and Bronze Material

	Yellow Brass	Red Brass 80%	Comm'l. Bronze	Duty	
Sheet	21¾c.	23 c.	24⅜	4c. lb.	U. S. Import Tax 4c. lb. on copper content.
Wire	22 c.	23¼c.	24⅝	20%	
Rod	18⅛c.	23¾c.	24½	4c. lb.	
Angles, channels	30¼c.	31½c.	32⅞	12c. lb.	
Seamless tubing	24½c.	25½c.	26⅝	8c. lb.	
Open seam tubing	30¼c.	31½c.	32⅞	20% a.v.	

Tobin Bronze and Muntz Metal

Net base prices per pound.	(Duty 4c. lb.; import tax 4c. lb. on copper content.)
Tobin Bronze Rod	23⅝c.
Muntz or Yellow Rectangular and other sheathing	25 c.
Muntz or Yellow Metal Rod	21⅛c.

Aluminum Sheet and Coil

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, ton lots, per lb.	35.50c
Aluminum coils, 24 ga., base price, ton lots, per lb.	31.00c

Rolled Nickel Sheet and Rod

(Duty 25% ad valorem, plus 10% if cold worked.)

Net Base Prices

Cold Drawn Rods	49c.	Cold Rolled Sheet	53c.
Hot Rolled Rods	44c.	Standard Sheet	48c.

Monel Metal Sheet and Rod

(Duty 25% ad valorem, plus 10% if cold worked.)

Hot Rolled Rods (base)	34	Standard Sheets (base)	38
Cold Drawn Rods (base)	39	Cold Rolled Sheets (base)	43

Silver Sheet

Rolled sterling silver (Mar. 26) 47c. per Troy oz. upward according to quantity. (Duty, 65% ad valorem.)

Zinc and Lead Sheet

	Cents per lb. Net Base	Duty
Zinc sheet, carload lots standard sizes and gauges, at mill, less 7 per cent discount	13.00	2c. lb.
Zinc sheet, 1200 lb. lots (jobbers' prices)	13.75	2c. lb.
Zinc sheet, 100 lb. lots (jobbers' prices)	17.75	2c. lb.
Full Lead Sheet (base price)	10.25	2⅝c. lb.
Cut Lead Sheet (base price)	10.50	2⅝c. lb.

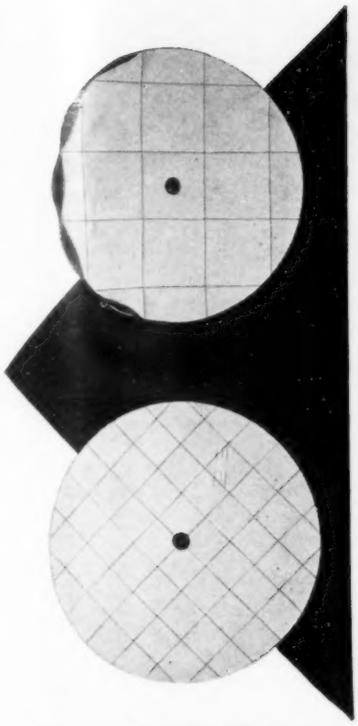
Block Tin, Pewter and Britannia Sheet

(Duty Free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs. over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply Prices on page 204.



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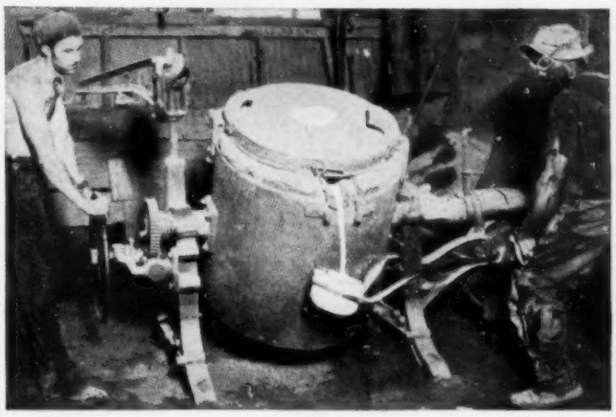

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Burn either Gas or Oil at Your Option

There is no "demand charge" for current that you do not use—no coal or coke or ashes to bother with, when your plant is equipped with Hausfeld Metal Melting Furnaces. Just open the valve on your gas line (during the months when gas is cheapest) or turn on your fuel oil valve when gas pressure is low—and presto! You have the hottest, most steady fire at the lowest possible cost. Down come your production costs! But your alloy analysis never changes!

Write for booklet of Comparative Melting Costs and Hausfeld Catalog

The Campbell-Hausfeld Company
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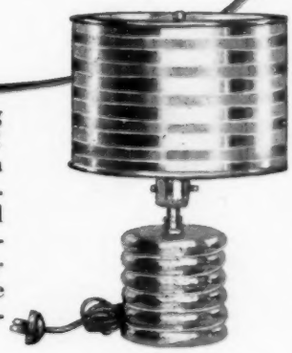

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BASIC METALS: Tin, Steel, Zinc, Brass, Copper.
FINISHES: Nickel, Chrome, Brass, Copper, Gold.
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Not the cheapest . . .
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RUMFORD CHEMICAL WORKS
RUMFORD, RHODE ISLAND

Supply Prices, March 25, 1937

Anodes

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 500 lbs. or more, and subject to changes due to fluctuating metal markets.

COPPER: Cast ..... 27 c. per lb.
Electrolytic, full size, 21⅞c. cut to size ..... 21⅞c. per lb.
Rolled oval, straight, 22⅜c.; curved ..... 22⅜c. per lb.
BRASS: Cast ..... 25 c. per lb.
ZINC: Cast ..... 14½c. per lb.
NICKEL: 90-92% ..... .45 per lb.
95-97% ..... .46 per lb.
99%+cast, 47c.; rolled, depolarized, 48.
SILVER: Rolled silver anodes .999 fine were quoted Mar. 26, from 48¼c. per Troy ounce upward, depending on quantity.

White Spanish Felt Polishing Wheels

Diameter	Thickness Under ½"	½-15/16"	1-2"	2-3½"	Over 3½"
Under 1"	6.35-6.40	6.20-6.25	6.10-6.15	6.10-6.15	6.35-6.40
1" to 1 7/16"	5.85	5.70	5.60	5.60	5.85
1½" to 3 15/16"	5.55	5.35-5.40	5.30-5.35	5.30-5.35	5.60
4-5 15/16"	4.95-5.00	4.70-4.85	4.65-4.75	4.65-4.75	4.95-5.00
6", 8" & 9"	3.80-4.25	3.45-3.95	2.45-3.05	2.45-3.00	2.90-3.35
10" to 18"	3.80-4.25	3.45-3.95	2.45-2.95	2.45-2.75	2.90-3.25
Over 18"	3.80-4.25	3.45-3.95	2.70-3.05	2.70-3.00	2.90-3.35

Prices above are for less than 50 lb. For 50 to 99 lb. deduct 5% from list; for 100 lb. and over deduct 10%.

ODD DIAMETERS: (7" & 11" to 17"). Less than 50 lb. add 40c per lb. to above "Even Diameters" list. 50 lb. or over—all one size and consistency and in one shipment—same as "Even Diameters" list above.

On grey Mexican wheels deduct 10c per lb. from above prices.

Cotton Buffs

Full disc open buffs, per 100 sections when purchased in lots of 100 or less are quoted:

16" 20 ply 84/92 Unbleached	$78.28
14" 20 ply 84/92 Unbleached	59.99
12" 20 ply 84/92 Unbleached	45.08
16" 20 ply 80/92 Unbleached	69.99
14" 20 ply 80/92 Unbleached	53.69
12" 20 ply 80/92 Unbleached	40.40
16" 20 ply 64/68 Unbleached	60.51
14" 20 ply 64/68 Unbleached	46.48
12" 20 ply 64/68 Unbleached	35.04

⅜" Sewed Buffs, per lb., bleached or unbleached 53c to $1.46

Chemicals

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone C. P.	lb.	.07½
Acid—Boric (Boracic) granular, 99½+% ton lots	lb.	.05¼-.05¾
Chromic, 400 or 100 lb. drums		.16¼-.16¾
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.03
Hydrochloric, C. P., 20 deg., carboys	lb.	.06½
Hydrofluoric, 30%, bbls.	lb.	.07-.08
Nitric, 36 deg., carboys	lb.	.05-.06¼
Nitric, 42 deg., carboys	lb.	.07-.08
Sulphuric, 66 deg., carboys	lb.	.029
Alcohol—Butyl, drums	lb.	.09½-.10½
Denatured, drums	gal.	.30-.476
Alum—Lump, barrels	lb.	.03¼-.03½
Powdered, barrels	lb.	.0340-.0365
Ammonia, aqua, com'l., 26 deg., drums, carboys	lb.	.02½-.05
Ammonium—Sulphate, tech., bbls.	lb.	.03½-.05
Sulphocyanide, technical crystals, kegs	lb.	.55-.58
Arsenic, white kegs	lb.	.04½-.05
Asphaltum, powder, kegs	lb.	.23-.41
Benzol, pure, drums	gal.	.41
Borax, granular, 99½+%, ton lots	lb.	.0245-.0295
Cadmium oxide, 50 to 1,000 lbs.	lb.	1.20
Calcium Carbonate (Precipitated Chalk), U. S. P.	lb.	.05¾-.07½
Carbon Bisulphide, drums	lb.	.05½-.06
Chrome, Green, commercial, bbls.	lb.	.21-.24
Chromic Sulphate, drums	lb.	.33-.55
*Copper—Acetate (Verdigris)	lb.	.28
Carbonate, 53/55% cu., bbls.	lb.	.19
Cyanide (100 lb. kgs.)	lb.	.39
Sulphate, tech., crystals, bbls.	lb.	.05¾-.0645
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.20¼-.20½
Crocus Martis (Iron Oxide) red, tech., kegs	lb.	.07
Dextrin, yellow, kegs	lb.	.05-.08
Emery Flour (Turkish)	lb.	.07
Flint, powdered	ton	30.00
Fluorspar, bags	lb.	.03½
*Gold Chloride	oz.	$18¼-23
*Gold Cyanide, Potassium		$15.45
*Gold Cyanide, Sodium		$17.10
Gum—Sandarac, prime, bags	lb.	.50
Shellac, various grades and quantities	lb.	.21-.31
Iron Sulphate (Copperas), bbls.	lb.	.016
Lead—Acetate (Sugar of Lead), bbls.	lb.	.13½-.16¼
Oxide (Litharge), bbls.	lb.	.12½
Lime Compositions for Nickel	lb.	.09½-.11
Lime Compositions for Brass	lb.	.09½-.11
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Methanol, (Wood Alcohol) Pure, drums	gal.	.40½
Nickel—Carbonate, dry bbls.	lb.	.36-.41
Chloride, bbls.	lb.	.18-.22
Salts, single, 425 lb. bbls.	lb.	.13½-.14½
Salts, double, 425 lb. bbls.	lb.	.13½-.14½
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash Caustic Electrolytic 88-92% broken, drums	lb.	.07¼-.08⅝
Potassium—Bichromate, casks (crystals)	lb.	.09
Carbonate, 98-100%	lb.	.06¾
Cyanide, 165 lbs. cases, 94-96%	lb.	.59
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Sal Ammoniac (Ammonium Chloride) in bbls.	lb.	.05-.07½
*Silver—Chloride, dry, 100 oz. lots	oz.	.38
Cyanide, 100 oz. lots	oz.	.44⅜
Nitrate, 100 ounce lots	oz.	.32¾
Soda Ash, 58%, bbls.	lb.	.0225
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.17½-.22
Hyposulphite, kegs, bbls.	lb.	.03½-.06½
Metasilicate, granular, bbls.	lb.	2.75-3.15
Nitrate, tech., bbls.	lb.	.0325
Phosphate, tribasic, tech., bbls.	lb.	.03
Silicate (Water Glass), bbls.	lb.	.01½
*Stannate, drums	lb.	.39-.42
Sulphocyanide, drums	lb.	.30-.35
Sulphur (Brimstone), bbls.	lb.	.02¾
*Tin Chloride, 100 lb. kegs	lb.	.46
Tripoli, powdered	lb.	.03
Trisodium Phosphate—see Sodium Phosphate.		
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
White Silica Compositions for Brass	lb.	.07½-.10
Whiting, Bolted	lb.	.02½-.06
Zinc—Carbonate, bbls.	lb.	.14-.15
Cyanide (100 lb. kegs)	lb.	.36-.38
Chloride, drums, bbls.	lb.	.07
Sulphate, bbls.	lb.	.0355

* Subject to fluctuations in metal prices.

IDING POLISHING CEMENT

The Successor to Glue in Wheel and Belt Polishing

8 EIGHT POINTS 8

of advantage

1. Elimination of preliminary preparation and cleaning of utensils after using, resulting in reduced labor costs.
2. No loss from spoilage.
3. Elimination of costly control instruments, glue containers and heat for maintaining glue.
4. Reduced cost wheel attention due to the elimination of glazing, making the application of pumice stone unnecessary.
5. Savings in labor of re-coating due to heat resistance of the cement.
6. Savings in adhesive and abrasive due to longer wear obtained from a cement set head because of heat resistance and ability to multiple "head" the polishing wheel when using cement.
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8. Reduction in standing investment in polishing wheels to approximately one-half the quantity required for glue, should artificial heat be used. Even in natural drying considerably fewer wheels are needed.

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FABRICATION - ASSEMBLING *"From Ingot to Finished Product"* PLATING - FINISHING

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